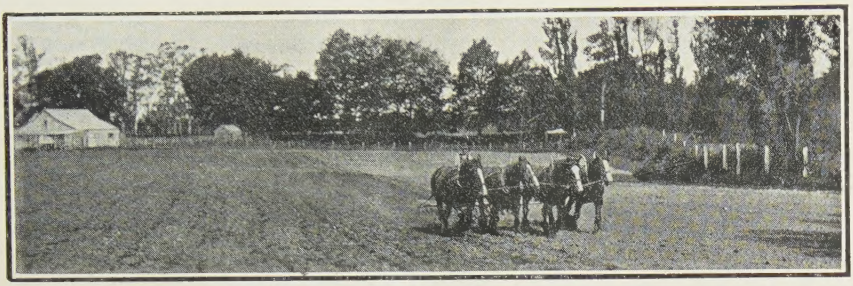

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THE GRASSLANDS OF NEW ZEALAND.

PRINCIPLES OF PASTURE-ESTABLISHMENT.

(Continued.)

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GRASS-SEED MIXTURES FOR VARIOUS SOILS AND CONDITIONS.

PERHAPS one of the greatest difficulties that confronts the farmer in the establishment of pasture is what to sow. In the preceding articles of this series the writer has not given very many types of mixtures for the respective soils, and those given represent what one might consider fair average mixtures for the types of country dealt with. Climate and farm-management, however, have a very decisive bearing on just what species should constitute the mixture sown. These vary from district to district, and thus a species which may be ideal for one set of climatic condition and for one style of farm-management may not suit another in the least, although the soil conditions may be almost identical. Nevertheless, when the subject of grasslands is studied undoubtedly one finds that under average normal conditions of farming, stocking, &c., there is a general reassortment of pasture-species, so that each type of soil becomes populated finally by more or less the same species of grasses and clovers, or by

the same class of weed-growth if those pasture plants more or less suited to that soil are not sown or are otherwise prevented from migrating on to such area.

In grassland research undoubtedly one of the first things necessary is accurately to determine just which species of grasses and clovers will persist on the various classes of soils under normal stocking-conditions. The second line of study is to learn exactly the developmental stages through which the pasture may go from the sowing until such time as the soil is populated with those species that are permanent there. The third line is to gauge the effect that the various types of farm-management have on the developmental stages that occur in the life-cycle of the pasture. Any really comprehensive system for devising grassland mixtures must be based on information derived from these three lines of study. In New Zealand our knowledge is not mature and conclusive on any one of these, but a sufficient amount of information has been gleaned to set down a more or less tentative scheme as a basis for grassland mixtures.

In the following Table 1 the leading types of soils are arranged consecutively according to their nature. Those species of grasses and clovers that will remain permanent under average normal stocking-conditions, on the various types of soils, are set down under the heading "Permanent Elements." These really represent those species that can persist on the various soils in virtue of the fact that they are naturally suited to or are in harmony with the existing environmental conditions. In the second column are set out those species which will last on the various types of soils for some two or three years, but which at the end of that period "run out," their place (theoretically) becoming occupied by certain of those species in the "Permanent Elements" column. These short-rotation elements are really successional species, and it is they which will form certain at least of the developmental stages in the pasture-cycle. Under certain conditions of farm-management the life of these species may be prolonged or shortened according to treatment meted out, and undoubtedly in almost every case the objective should be to prolong the life of such species as far as possible by careful manipulation of stock and by top-dressing with artificial manures, for it will be observed that in a great number of soil-types the final permanent species which that soil is capable by itself of supporting are inferior in quality, palatability, and carrying-capacity. In the third column are set out the purely temporary elements of the sowings—those that will last for one or at most two years. These will come away early in the grassland cycle, and will constitute the first developmental stages in the life of the pasture. The stage is purely temporary, and care must be exercised that this stage does not overdevelop, else the resulting stages may be seriously affected.

It will be noted that in the table the same species often figures in more than one column. This serves to indicate, in the case of the permanent elements, that those species are more inclined to "go out" at the end of the time specified at the top of the column than to persist as really permanent elements. It means, in fact, that the latter are permanent only under good careful management. In the case of the temporary elements persisting, in certain cases this is due largely

to understocking, or to the soil conditions being favourable to re-establishment from seed that has fallen the previous summer. Again, among the permanent elements, it will be noted, are many species, and it is not expected that in any one pasture-sowing all those given in the list will be included in the one pasture-mixture. Thus in sowing down high-class swamp-lands cocksfoot, perennial rye-grass, timothy, red clover, and white clover may be all that the farmer requires as permanent elements; or the objective on that same soil may be a meadow-foxtail and Poa trivialis pasture; and, again, under exceptional conditions a paspalum or a prairie-grass pasture.

According to requirements, then, those permanent elements that the farmer wishes his pasture to consist of are selected out of the permanent elements list for any one respective soil-type, and these having been selected other elements from the short-rotation column and from the temporary column are chosen, and a mixture thus compiled.

In the last column for each respective soil-type are given the names of some common plants which are likely to prove aggressive in the established grassland. Such plants, on the whole, must be looked upon as undesirable constituents, and farm-management must be directed towards the prevention of their entry, else they will come in and crowd out altogether, or at least take the place of, certain of the desirable grassland constituents. It will be noted that in quite a number of instances certain grasses and clovers are necessary and desirable on certain types of soil, but are ranked undesirable when present in certain other types of soil. Tall fescue, for example, is an unmitigated weed on high-class swamp-land, whereas it may fill a very important place on certain poor grassland soils. Brown-top, also, is a very valuable grass for certain poorer types of short-rotational grassland soils, yet it must be ranked as undesirable on the major portion of the first-class short-rotational soils that so frequently become invaded by this grass, and which really should be carrying a pasture of the cocksfoot, crested dogstail, white clover type.

TABLE I, INDICATING DURATION OF THE VARIOUS PASTURE-GRASSES AND CLOVERS ON THE DIFFERENT GRASSLAND SOILS.

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
Good Average First-class Ploughable Country.			
Cocksfoot Timothy Perennial rye-grass Crested dogstail Meadow-fescue Prairie-grass Paspalum Red clover White clover Subterranean clover.	Red clover Perennial rye-grass Alsike Prairie-grass.	Italian rye-grass Western Wolths rye-grass Crimson clover Alsike.	Yorkshire fog Field-daisy Ox-eye daisy Rushes Blackberry Californian thistle Ragwort Creeping buttercup Plantain Self-heal.

TABLE I—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
High-class Swamp-lands and Alluvial River Deposits.			
Cocksfoot Perennial rye-grass Timothy Meadow-foxtail Poa trivialis Paspalum Prairie-grass Italian rye-grass Phalaris bulbosa Red clover Lotus major Alsike White clover.	Red clover Perennial rye-grass Italian rye-grass Western Wolths rye-grass Alsike Prairie-grass.	Italian rye-grass Western Wolths rye-grass Crimson clover.	Tall fescue Poa aquatica Yorkshire fog Rushes Pennyroyal Field-daisy Reed canary-grass Blackberry Creeping buttercup Goat's-rue.
Wet Undrained Swamps.			
Lotus major Yorkshire fog Red-top Timothy Glyceria fluitans.	Timothy Perennial rye-grass Alsike.	Perennial rye-grass Western Wolths rye-grass Italian rye-grass Alsike.	Rushes Sedges Tall fescue Poa aquatica Reed canary-grass Raupo.
Raw Peat Swamp-lands, unconsolidated.			
Lotus major Paspalum Brown-top Red-top Yorkshire fog.	Perennial rye-grass Yorkshire fog Red clover.	Italian rye-grass Western Wolths rye-grass Perennial rye-grass Red clover White clover.	Manuka Fern Sorrel Blackberry Rushes.
Consolidated Peat-swamp.			
Cocksfoot Crested dogstail Paspalum Timothy Poa pratensis Lotus major White clover Subterranean clover.	Perennial rye-grass Red clover Timothy.	Italian rye-grass Western Wolths rye-grass Red clover Alsike Crimson clover.	Yorkshire fog Brown-top Red-top Danthonia Sorrel Pennyroyal Blackberry Californian thistle.
First-class Short-rotational Grassland Soils; the better Second-class Soils in general.			
Cocksfoot Crested dogstail Timothy Paspalum Tall oat-grass Meadow-fescue White clover Subterranean clover Lotus major.	Perennial rye-grass Red clover Timothy Meadow-fescue.	Italian rye-grass Western Wolths rye-grass Alsike Crimson clover.	Yorkshire fog Brown-top Catsear Rib-grass Plantain Goose-grass Ragwort Californian thistle St. John's wort.

TABLE I—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
Poor Short-rotational Grassland Soils, Shingly River-beds, Poor Clays, &c.			
Cocksfoot Crested dogstail Brown-top Chewings fescue Poa pratensis Danthonia Paspalum Yorkshire fog Tall fescue Lotus hispidus Lotus major Suckling-clover White clover.	Perennial rye-grass Red clover White clover Cocksfoot Crested dogstail.	Italian rye-grass Western Wolths rye-grass Red clover.	Sweet vernal Hair-grass Goose-grass Rib-grass Catsear English hair-grass Tarweed Twitch Yarrow St. John's wort Gorse Broom Manuka.
Soil of a Saline Nature; Reclaimed Tidal Flats, &c.			
Peren'l rye-grass Cocksfoot Timothy Crested dogstail Meadow-foxtail Poa trivialis Paspalum Strawberry clover White clover Alsike. Lotus major	Perennial rye-grass Italian rye-grass Red clover Alsike.	Italian rye-grass Western Wolths rye-grass.	Tall fescue Shore plantain Rushes Pennyroyal Large-leaved plantain.
Moving Sands of the Dune Complex.			
Marram-grass Spinifex Pingao. (Established by planting.)	Yellow lupin King Island melilot Bokhara clover Yorkshire fog Brown-top. (Sown in established marram, &c., or on fixed sands behind dunes.)		
Fixed Sands following on previous Type.			
Paspalum Ratstail New Zealand rice-grass Danthonia Poa pratensis Yorkshire fog Suckling-clover Lotus hispidus Clustered clover Striated clover Burr clovers.	Perennial rye-grass Red clover King Island melilot Yorkshire fog.	Italian rye-grass Red clover.	Evening primrose Tauhinu.

TABLE I—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
Old Stabilized Sand Areas.			
Crested dogstail Poa pratensis Paspalum Cocksfoot Ratstail New Zealand rice-grass Danthonia Hair-grass Yarrow English trefoil Annual clovers.	Perennial rye-grass Red clover.	Italian rye-grass Red clover (Rape or Japanese millet as cover-crops).	Wiwi Mariscus Tauhinu Sheep's burr Piripiri (hutiwai) Hair-grass English hair-grass Catsear.
Volcanic Soils and Light Sandy Loams.			
Cocksfoot Crested dogstail Peren'l rye-grass Paspalum Poa pratensis Prairie-grass Red clover White clover Subterranean clover.	Perennial rye-grass Red clover Prairie-grass	Italian rye-grass Western Wolths rye-grass Alsike.	Sweetbriar Inkweed Sorrel Apple of Sodom Cretian mullein.
Limestone Soils.			
Cocksfoot Crested dogstail Perennial rye-grass Poa pratensis Poa trivialis Meadow-foxtail Paspalum Strawberry clover Subterranean clover Lucerne English trefoil Lotus major White clover.	Perennial rye-grass Red clover Alsike.	Italian rye-grass Western Wolths rye-grass Alsike.	Ratstail Tall fescue Pennyroyal Horehound Plantain Catsear Blackberry Californian thistle.
First-class Forest-lands; Tawa, Rimu, White-pine, Big Rata, Big Kamahi, Puriri, Tall Bracken-fern, &c.			
Cocksfoot Crested dogstail Poa pratensis Timothy Perennial rye-grass Meadow-foxtail Poa trivialis Paspalum White clover Lotus major Yarrow.	Perennial rye-grass Red clover Timothy Alsike.	Italian rye-grass Western Wolths rye-grass Alsike.	Water-fern Hard-fern Bracken-fern Rushes Blackberry Plantain Creeping buttercup Tutu Piripiri (hutiwai) Pennyroyal Tall fescue.

TABLE 1—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
Second-class Steep Forest-lands; Totara, Kamahi, Upland Kauri, Beech, Coastal Forest, and Bracken-fern 2 ft. to 3 ft. high.			
Cocksfoot Crested dogstail Poa pratensis Danthonia Brown-top Chewings fescue Paspalum Yorkshire fog Lotus spp. White clover Yarrow Subterranean clover.	Cocksfoot Crested dogstail Perennial rye-grass Red clover.	Italian rye-grass Alsike.	Bracken-fern Hard-fern Manuka Piripiri (hutiwai) Rushes Catsear St. John's wort Californian thistle Foxglove Tutu Sweetbriar Tutsan Gorse.
Third-class Stunted Forest and Scrub Lands.			
Chewings fescue Danthonia Brown-top Poa pratensis Paspalum Yorkshire fog Lotus hispidus Suckling-clover White clover Yarrow.	Cocksfoot Crested dogstail Perennial rye-grass Red clover White clover.	Italian rye-grass Red clover Perennial rye-grass.	Manuka Mingimingi Pomaderris Tauhinu Piripiri (hutiwai) Stunted fern Catsear Sweetbriar Gorse.

From the foregoing table one may judge fairly well the species that should be selected for the pasture-mixture, but no clue is there given as to the quantity of seed of each to use. The following mixtures have been drawn up and are put forward as a guide to the quantities of each species that should be included in the mixture. They are grouped under the respective soils, and consist of permanent, rotation, and temporary-pasture mixtures.

Soil-type 1: Good Average First-class Ploughable Country.

PERMANENT PASTURES.

(1.) *Average General Mixture.*

	lb.
Perennial rye-grass	15
Cocksfoot	10
Crested dogstail	3
Timothy	3
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	40

(2) *Adopting Use of Meadow-fescue.*

	lb.
Perennial rye-grass	15
Cocksfoot	6
Meadow-fescue	6
Crested dogstail	3
Timothy	3
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	42

PERMANENT PASTURES—*continued.*

(3.) *For Establishment of Paspalum.*

	lb.
Perennial rye-grass	15
Cocksfoot	6
Italian rye-grass	8
Paspalum	6
Red clover	3
White clover	2
Subterranean clover	1
Total per acre	41

(4.) *For Establishment of Prairie-grass.*

	lb.
Perennial rye-grass	8
Prairie-grass	60
Italian rye-grass	6
Red clover	4
Total per acre	78

SHORT-ROTATION PASTURES (2–4 YEARS' DURATION).

(1.) *General Grazing Type.*

	lb.
Perennial rye-grass	20
Italian rye-grass	8
Red clover	6
Total per acre	34

(2.) *Grazing and Hay Type.*

	lb.
Perennial rye-grass	15
Cocksfoot	6
Timothy	4
Italian rye-grass	8
Red clover	4
Alsike	2
Total per acre	39

A fed-off cereal or rape cover-crop may be included in these short-rotation pastures. The Italian rye-grass may then be left out.

TEMPORARY PASTURES (1–2 YEARS' DURATION).

(1.)

	lb.
Italian rye-grass	12
Western Wolths rye-grass	12
Red clover	6
Total per acre	30

(2.)

	lb.
Italian rye-grass	25
Red clover	6
Total per acre	31

If Western Wolths is substituted for Italian rye-grass in No. 2 more rapidly produced feed is secured. For late autumn sowings 2 lb. of alsike should be added to the mixtures.

Soil-type 2: High-class Swamp and Alluvial River Deposits.

PERMANENT PASTURES.

(1.)

	lb.
Perennial rye-grass	12
Cocksfoot	10
Timothy	4
Italian rye-grass	4
Meadow-foxtail	4
Poa trivialis	2
Red clover	2
Alsike	2
White clover	2
Total per acre	42

(2.)

	lb.
Perennial rye-grass	15
Cocksfoot	10
Timothy	6
Italian rye-grass	4
Red clover	4
Alsike	2
White clover	1
Lotus major	1
Total per acre	43

Prairie-grass and paspalum pastures may be established by using mixtures 4 and 3 respectively given under soil-type 1. Paspalum is not particularly recommended on these specially rich types of soil, as more palatable grasses may be successfully used.

SHORT-ROTATION PASTURES (2–4 YEARS' DURATION).

(1.)	lb.
Perennial rye-grass	8
Italian rye-grass	15
Timothy	8
Red clover	6
White clover	2
Total per acre	39

(2.)	lb.
Perennial rye-grass	10
Italian rye-grass	20
Red clover	4
Alsike	2
White clover	2
Total per acre	38

A fed-off cereal or rape cover-crop may be used in these short-rotation pasture-mixtures similarly to those of soil-type 1.

TEMPORARY PASTURES (1–2 YEARS' DURATION).

(1.)	lb.
Western Wolths rye-grass	25
Red clover	6
Total per acre	31

(2.)	lb.
Italian rye-grass	12
Western Wolths rye-grass	12
Red clover	4
Alsike	2
Total per acre	30

Crimson clover, 2 lb., may be added to these and the red clover correspondingly reduced.

Soil-type 3: Peat Swamp-lands.

SUB-TYPE A: RAW UNCONSOLIDATED AND UNPLOUGHABLE.

Breaking-in Mixtures, Surface-sown.

(1.)	lb.
Yorkshire fog	8
Perennial rye-grass	6
Italian rye-grass	3
Red-top	1
Brown-top	1
Lotus major	2
Total per acre	21

(2.)	lb.
Yorkshire fog	6
Paspalum	3
Brown-top	1
Perennial rye-grass	6
Italian rye-grass	3
Lotus major	2
Total per acre	21

Seed spread by means of hay fed out on to these areas is more successful than the mere surface-sowing of seed.

SUB-TYPE B: RAW UNCONSOLIDATED PEAT SWAMP-LANDS, PLOUGHED.

First phase: Breaking-in consolidating pasture-mixtures are as follows:—

(1.)	lb.
Yorkshire fog	8
Lotus major	2
Perennial rye-grass	8
Italian rye-grass	6
Total per acre	24

(2.)	lb.
Yorkshire fog	6
Paspalum	3
Brown-top	1
Perennial rye-grass	8
Italian rye-grass	6
Lotus major	2
Total per acre	26

Second phase: The area is reploughed and sown by one of the following mixtures:—

(1.)	lb.	(2.)	lb.
Italian rye-grass	12	Western Wolths rye-grass	25
Western Wolths rye-grass	12	Red clover	6
Red clover	6	White clover	2
White clover	2		
Total per acre	32	Total per acre	33

Third phase: In the second year of the above temporary sowing introduce permanent elements, either by surface-sowing of seed or by feeding-out of hay containing ripe seed of the desired permanent elements. Cover seed with the harrows. Top-dressing seed-mixtures are as follows:—

(1.)	lb.	(2.)	lb.
Cocksfoot	10	Cocksfoot	10
Crested dogstail	3	Crested dogstail	3
Timothy	2	Paspalum	4
Perennial rye-grass	10	Perennial rye-grass	10
White clover	2	White clover	2
Total per acre	27	Subterannean clover	1
		Total per acre	30

SUB-TYPE C: MATURELY CONSOLIDATED PEAT SWAMP-LANDS.

PERMANENT PASTURES.

(1.)	lb.	(2.)	lb.
Cocksfoot	15	Cocksfoot	8
Crested dogstail	3	Crested dogstail	2
Timothy	3	Perennial rye-grass	10
Perennial rye-grass	10	Italian rye-grass	6
Italian rye-grass	6	Paspalum	3
Red clover	3	Red clover	2
White clover	2	White clover	1
Lotus major	2	Lotus major	1
Total per acre	44	Subterranean clover	1
		Total per acre	34

SHORT-ROTATION PASTURES, 2–3 YEARS.

	lb.
Perennial rye-grass	25
Red clover	6
White clover	2
Total per acre	33

TEMPORARY PASTURES, 1–2 YEARS.

(1.)	lb.	(2.)	lb.
Italian rye-grass	25	Western Wolths rye-grass	25
Red clover	6	Red clover	6
Total per acre	31	Total per acre	31

Soil-type 4: Wet Low-lying Undrained Swamps.

This type is capable of being grazed only in the summer and of being sown in the autumn following a burning-off of nigger-head,

Mariscus, and other plants which usually populate these areas. The following mixture is suggested :—

	lb.
Yorkshire fog	8
Perennial rye-grass	8
Brown-top	1
Timothy	4
Lotus major	2
Total per acre	23

Glyceria fluitans (sweet floating-grass) should be introduced if possible, but seed is at present not available commercially. The plant is very common in New Zealand, and is to be found in almost all waterlogged areas where the water is on the move.

Soil-type 5 : First-class Short-rotational Grassland Soils—Good Second-class Soils in general.

PERMANENT PASTURES.

(1.)	lb.
Cocksfoot	15
Crested dogstail	4
Perennial rye-grass	10
Timothy	2
Red clover	3
White clover	2
Total per acre	36

(2.)	lb.
Cocksfoot	10
Crested dogstail	4
Meadow-fescue	6
Perennial rye-grass	10
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	39

(3.)	lb.
Cocksfoot	8
Crested dogstail	2
Perennial rye-grass	10
Italian rye-grass	4
Paspalum	4
Red clover	3
White clover	2
Subterranean clover	1
Total per acre	34

SHORT-ROTATION PASTURES.

(1.) *2–3 Years' Duration.*	lb.
Perennial rye-grass	25
Red clover	6
Total per acre	31

(2.) *3–4 Years' Duration.*	lb.
Perennial rye-grass	20
Cocksfoot	8
Timothy	2
Red clover	4
White clover	2
Total per acre	36

TEMPORARY PASTURES, 1–2 YEARS.

Italian rye-grass, 25 lb.; red clover, 6 lb.: total per acre, 31 lb.

Soil-type 6 : Second-class Short-rotational Grassland Soils, Gravels, Poor Clays, &c.

PERMANENT PASTURES.

(1.) *For Slightly Wet Situations.*	lb.
Cocksfoot	6
Crested dogstail	2
Waipu brown-top	2
Poa pratensis	1
Perennial rye-grass	10
Italian rye-grass	6
Red clover	2
White clover	1
Total per acre	30

(2.) *For Conditions Similar to No. 1.*	lb.
Perennial rye-grass	15
Italian rye-grass	6
Waipu brown-top	2
Yorkshire fog	2
Poa pratensis	2
Crested dogstail	2
Red clover	2
White clover	1
Total per acre	32

PERMANENT PASTURES—*continued.*

(3.) *For Drier Conditions than No. 2.*

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Chewings fescue	4
Danthonia pilosa	2
Tall fescue	2
Red clover	2
White clover	1
Total per acre	30

(4.) *For Establishment of Paspalum.*

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Waipu brown-top	2
Paspalum	3
Crested dogstail	2
Lotus major	1
Red clover	2
White clover	1
Subterranean clover	1
Total per acre	31

(5.) *For Establishment of Chewings Fescue for Seed.*

	lb.
Perennial rye-grass	20
Italian rye-grass	6
Chewings fescue	4
Red clover	2
White clover	1
Total per acre	33

Mixtures for short-rotation pastures, 2–3 years, and temporary pastures, 1–2 years' duration, are as for soil-type 5.

Soil-type 7: Saline Soils, Reclaimed Tidal Flats, &c.

PERMANENT PASTURES.

(1.)	lb.
Perennial rye-grass	15
Italian rye-grass	4
Timothy	3
Meadow-foxtail	3
Poa trivialis	1
Cocksfoot	8
Red clover	3
Strawberry-clover	1
White clover	1
Lotus major	½
Total per acre	39½

(2.)	lb.
Perennial rye-grass	15
Italian rye-grass	4
Timothy	4
Cocksfoot	10
Red clover	3
Lotus major	1
Strawberry-clover	1
White clover	1
Total per acre	39

(3.) *For Establishment of Paspalum.*

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Timothy	2
Cocksfoot	6
Paspalum	3
Lotus major	1
Strawberry-clover	1
White clover	1
Subterranean clover	1
Total per acre	34

Mixtures for short-rotation pasture, 2–4 years, and temporary pastures are similar to those given for soil-type 1. Certain of these soils are admirably adapted for lucerne, and in certain instances the inclusion of 2 lb. of lucerne per acre in the grass-mixture is to be recommended.

Soil-type 8: Coastal Sand Areas.

SUB-TYPE A: MOVING AND UNCONSOLIDATED SANDS.

First phase: Plant roots of marram, Spinifex, or pingao.

Second phase: Sow yellow lupin (best sown in the pod), or plant ice-plant (in North Island only), on the areas stabilized by the marram, &c.

Third phase: Sow among lupin, &c., the following mixture:—

	lb.
Yorkshire fog	4
Perennial rye-grass	6
Poa pratensis	2
Waipu brown-top	6
Paspalum	4
King Island melilot	2
English trefoil	2
Lotus hispidus	2
Subterranean clover	1
Total per acre	24

SUB-TYPE B: STABILIZED SANDS.

PERMANENT PASTURES.

(1.) *For Undulating Portions.*	lb.
Cocksfoot	12
Crested dogstail	3
Perennial rye-grass	10
Poa pratensis	2
Danthonia pilosa	2
Waipu brown-top	1
Red clover	2
White clover	2
English trefoil	2
Total per acre	36

(2.) *For Wetter Sand-plains.*	lb.
Cocksfoot	15
Crested dogstail	3
Perennial rye-grass	10
Italian rye-grass	4
Timothy	3
Red clover	2
English trefoil	2
White clover	2
Total per acre	41

(3.) *For Establishment of Paspalum.*	lb.
Perennial rye-grass	12
Italian rye-grass	4
Cocksfoot	8
Crested dogstail	2
Waipu brown-top	1
Paspalum	4
Red clover	2
White clover	2
Subterranean clover	1
Total per acre	36

These mixtures are best sown in rape-stubble in the autumn, or along with rape in the early spring. Mixtures for short-rotation, 2–3 years, and temporary pastures, 1-2 years' duration, are as for soil-type 5.

Soil-type 9: Volcanic Soils.

SUB-TYPE A: PLOUGHABLE SCORIA TYPE.

PERMANENT PASTURES.

(1.) *Damp and Low-lying.*	lb.
Cocksfoot	10
Timothy	4
Perennial rye-grass	15
Poa trivialis	2
Meadow-foxtail	4
Red clover	3
White clover	2
Total per acre	40

(2.) *More Elevated and Sloping.*	lb.
Cocksfoot	15
Crested dogstail	4
Timothy	2
Perennial rye-grass	10
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	40

(3.) *For Establishment of Paspalum.*	lb.
Cocksfoot	8
Crested dogstail	3
Perennial rye-grass	12
Italian rye-grass	4
Paspalum	4
Red clover	2
White clover	1
Subterranean clover	1
Total per acre	35

SUB-TYPE B: PUMICE TYPE.

(1.) *Unconsolidated.*	lb.
Italian rye-grass	10
Perennial rye-grass	10
Yorkshire fog	6
Waipu brown-top	2
Red clover	4
Lotus major	1
White clover	1
Lotus hispidus	1
Total per acre	35

(2.) *Consolidated.*	lb.
Cocksfoot	15
Crested dogstail	4
Perennial rye-grass	10
Red clover	4
White clover	2
Lotus major	1
Total per acre	36

Soil-type 10: Limestone Soils.

SUB-TYPE A: PLOUGHABLE.

PERMANENT PASTURES.

(1.)	lb.	(2.)	lb.
Cocksfoot	12	Cocksfoot	8
Crested dogstail	3	Crested dogstail	3
Perennial rye-grass	10	Perennial rye-grass	12
Timothy	3	Italian rye-grass	4
Italian rye-grass	4	Paspalum	4
English trefoil	2	Red clover	2
Lucerne	2	English trefoil	2
Red clover	1	Lotus major	1
	—	Subterranean clover	1
Total per acre	39	White clover	1
			—
		Total per acre	38

Mixtures for short-rotation pastures, 2–4 years, and temporary pastures, 1–2 years' duration, are as for soil-type 1.

SUB-TYPE B: STEEP AND UNPLOUGHABLE (PAPA SOILS).

(1.) *For Wetter Shady Slopes.*	lb.	(2.) *For Drier and Poorer Slopes.*	lb.	(3.) *For Establishment of Paspalum.*	lb.
Cocksfoot	10	Cocksfoot	10	Cocksfoot	10
Crested dogstail	3	Crested dogstail	3	Crested dogstail	3
Poa pratensis	1	Poa pratensis	2	Perennial rye-grass	10
Meadow-foxtail	2	Yorkshire fog	2	Paspalum	4
Poa trivialis	1	Waipu brown-top	1	Red clover	2
Perennial rye-grass	8	Perennial rye-grass	10	Lotus major	1
Italian rye-grass	4	Red clover	2	White clover	1
Red clover	2	White clover	1	Subterranean clover	1
Lotus major	1	English trefoil	1		—
English trefoil	1		—	Total per acre	32
White clover	1	Total per acre	32		
	—				
Total per acre	34				

Soil-type 11: First-class Forest Lands.

SUB-TYPE A: LOWLAND, FLAT OR UNDULATING, OF THE TAWA, RIMU, WHITE-PINE, PUKATEA FOREST TYPE.

(1.)	lb.	(2.)	lb.
Cocksfoot	10	Cocksfoot	15
Crested dogstail	2	Crested dogstail	2
Timothy	4	Perennial rye-grass	8
Perennial rye-grass	10	Timothy	4
Meadow-foxtail	2	Italian rye-grass	4
Poa trivialis	1	Red clover	3
Italian rye-grass	4	Lotus major	1
Red clover	2	White clover	2
White clover	2		—
Lotus major	1	Total per acre	39
	—		
Total per acre	38		

SUB-TYPE B: STEEP OR UNDULATING, OF THE BIG RATA, PURIRI, BIG KAMAHI, TAWA, TALL BRACKEN-FERN TYPE.

(1.)	lb.
Cocksfoot	10
Crested dogstail	4
Poa pratensis	2
Danthonia pilosa	2
Timothy	2
Perennial rye-grass	8
Italian rye-grass	4
Red clover	2
White clover	2
Lotus major	½
Total per acre	36½

(2.)	lb.
Cocksfoot	8
Crested dogstail	3
Timothy	2
Perennial rye-grass	10
Italian rye-grass	4
Paspalum	4
Red clover	2
White clover	1
Lotus major	1
Total per acre	35

Soil-type 12: Second-class Forest Lands—Totara, Matai, Hinau, Rewarewa, Kamahi, Southern Beech, Upland Kauri; Bracken-fern, 2-3 ft. high, or Strong Manuka.

(1.)	lb.
Cocksfoot	8
Crested dogstail	3
Perennial rye-grass	8
Waipu brown-top	1
Yorkshire fog	2
Danthonia pilosa	2
Italian rye-grass	2
Lotus hispidus	1
White clover	1
Lotus major	½
Yarrow	¼
Total per acre	28¾

(2.)	lb.
Cocksfoot	8
Crested dogstail	3
Perennial rye-grass	8
Chewings fescue	4
Waipu brown-top	2
Italian rye-grass	2
Lotus hispidus	1
White clover	1
Lotus major	½
Yarrow	¼
Total per acre	29¾

(3.)	lb.
Cocksfoot	8
Crested dogstail	3
Perennial rye-grass	8
Paspalum	4
Lotus hispidus	1
Italian rye-grass	2
White clover	1
Lotus major	1
Total per acre	28

Soil-type 13: Third-class Forest Lands—Stunted Forest and Scrub; Upland Dry-face Beech; Short Fern.

(1.) *For Dry Slopes.*	lb.
Perennial rye-grass	8
Tall fescue	2
Waipu brown-top	2
Chewings fescue	4
Danthonia pilosa	2
Yorkshire fog	4
White clover	1
Suckling-clover	1
Yarrow	1
Total per acre	25

(2.) *For Damper Slopes.*	lb.
Perennial rye-grass	8
Crested dogstail	2
Waipu brown-top	2
Yorkshire fog	8
Danthonia pilosa	2
White clover	1
Suckling-clover	1
Yarrow	1
Total per acre	25

(3.) *For Establishment of Paspalum.*	lb.
Perennial rye-grass	10
Waipu brown-top	2
Yorkshire fog	4
Paspalum	4
White clover	1
Suckling-clover	1
Total per acre	22

In putting forward the foregoing set of mixtures the writer does not claim that these represent the final word in connection with grass-mixture formulas. They are based upon the developmental study of grasslands as they occur in New Zealand to-day. More efficient farm-management may show that certain of those stages of the pasture succession which the writer now looks upon as transient may be made more or less permanent. This in itself would be

sufficient to considerably modify the present formulas. Farm-management will to a very large extent finally govern the type of mixture sown, but under the present system of grass farming it seems much the wiser plan to include in the permanent-pasture mixtures those species of grasses and clovers that are able to adapt themselves naturally to the conditions as they now appear in grassland-management.

The quantity of seed recommended in mixtures here given is in general higher than is usually sown at the present time, and, while certain reduction might be made throughout, the writer is confident that the specified amount of seed sown will reflect very beneficially in the character of the resultant pasture. There is no doubt that farmers can rely on introducing certain permanent elements in a more or less indirect fashion, by the manipulation of their stock and by the manner in which the latter are fed. Thus many grasses may be transferred adhering to the wool of sheep, or carried from one paddock to another by means of their dung. It is common knowledge that on many soils white clover need not be sown, as it comes in naturally. This is true also of old pastures containing Lotus major, paspalum, Poa pratensis, or brown-top—these plants readily re-establishing themselves either from seed shed or by renewed growth of their underground stems or rootstocks that have not been killed out in the working of the land. A knowledge of just what vegetation will assert itself when the pasture is laid down will influence very largely the actual grass-mixture that is applied to that land. The farmer, therefore, by knowing what seed there is in the ground, or by a knowledge of certain indirect methods of introducing seed to the ground, may be able to save a certain amount on his mixtures, but it is a wise plan to err on the safe side and to make sure that those desirable species are safely introduced.

Farmers who are just starting on the land, if that land be ploughable, are recommended more to adopt (for some years at least) the temporary and rotational mixtures rather than the permanent ones. The former are in general cheaper to put down—an important consideration—and while adoption of the short-rotational pastures means more actual work the return is greater and more rapid. The permanent pasture really pertains to the well-established man who can afford to spend more and to wait longer for a return. In the latter case invested money brings its return : in the former case, where money is lacking, one has to spend less and rely more on hard work.

Mention may also be made of a point with regard to paspalum establishment and to the establishment of the clovers associated with it, particularly subterranean clover. To establish successfully, paspalum likes for preference a well-consolidated seed-bed, and certain farmers in the North are of the opinion that this seed should not be sown with the original sowing, but should be surface-sown later, in the second year, after consolidation of the surface has taken place through stocking. Again, on the better classes of soil subterranean clover is very likely to get away in the early spring and to cause injury to the grass sward by its smother. In such case paspalum, which is slow to establish, may also be smothered out. So far as this clover is concerned it would appear best to get the paspalum established and then to sow seed of subterranean clover on to the paspalum.

It should not be necessary to emphasize that this land seed-mixtures is a most important one. The selec... grasses and clovers and their establishment really afford—u... Zealand conditions—a starting-point for the display and bring... bear of rational, efficient farm-management. No matter how goo... a farmer may be or how excellent his management he is seriously handicapped if his paddocks are filled with inferior grasses and weeds.

The subject of the quality of the seed sown for pastures will be dealt with in the next article of this series.

MANURIAL EXPERIMENTS IN CANTERBURY.

SOME PROGRESS OBSERVATIONS.

F. E. WARD, Instructor in Agriculture, Christchurch.

OWING to the comparative lack of authentic information concerning various phases of manuring in Canterbury, special efforts have been made during the past season to procure data upon which some reliance can be placed. The work was commenced rather late; therefore the present experiments had to be confined to top-dressing of pasture and the manuring of turnips and mangolds. It is clearly understood that one season's work can in no way be taken as conclusive, but the results of the tests up to the time of writing so emphatically confirm previous experience that a brief progress report is justified. The tests are organized on a co-operative basis, the farmers chosen being men who are willing to continue the experiments for a number of years.

PASTURES.

Three top-dressing experiments were planned on different types of soil—namely, heavy loam in a damp situation, medium loam in a drier situation, and on typical light Plains country. The two first-mentioned tests were on pasture intended for hay, to be followed by a crop of red clover. The last-mentioned was conducted as a feeding-test only. In each of the first two trials the fertilizers used included superphosphate, basic super, super and lime, and Nauru raw rock phosphate. A mixture of potash and ammonium sulphate was applied across a portion of the plots in each case.

On the heavy damp loam it was difficult to discern any difference in the growth of hay, but on taking green weights the basic superphosphate plots gave the highest yields. The rock phosphate (in keeping with its slow-acting character) gave no appreciable increase, and the value of potash and nitrogen appeared to be of negligible value. The aftergrowth was even throughout, there being no apparent difference.

On the medium loam, in a drier locality, the results were very marked. The effects of superphosphate were most remarkable, both in the hay crop and in the subsequent growth of clover. Nauru rock again gave no increase, the same applying to the dressing of potash and nitrogen. If anything, potash had the effect of depressing the yield.

FIG. 1. AFTERGROWTH ON HAYFIELD, PERRYMAN BROS.' FARM, TAI TAPU.

On left, 2 cwt. superphosphate per acre; on right, control (no manure). Photo taken in January last, five months after top-dressing. Pasture three years old.

FIG. 2. ANOTHER VIEW IN THE SAME FIELD, SEVEN MONTHS AFTER TOP-DRESSING.

On left, control; on right, 2 cwt. superphosphate per acre. Photo taken in March.

FIG. 3. TURNIPS AT ASHBURTON EXPERIMENTAL FARM, SHOWING ADVERSE EFFECT OF SUPERPHOSPHATE SOWN IN CONTACT WITH THE SEED, ON LIGHT LAND.

On left, 2 cwt. superphosphate; on right, 1 cwt. superphosphate.

FIG. 4. MANGOLD TEST PLOT ON MR. J. PARLANE'S FARM, CASHMERE, SHOWING OUTSTANDING EFFECT OF SUPERPHOSPHATE ALONE.

The two middle rows received 2 cwt. superphosphate per acre. The first row to the left is the control; for other manures see text.

The grazing experiment was made as simple as possible in order to reduce the work entailed in weighing sheep on and off. The test was made with superphosphate against basic super and control. The area of each plot was 2 acres. Seventeen ewe hoggets were put on each plot on 11th December and removed on 10th March last. The fertilizers were applied on 8th September last. They therefore had not a really good chance, and these figures do not show an economical return for the expenditure to date. The results show in favour of 2 cwt. of superphosphate per acre, which gave a gain in weight of 94 lb. over the unmanured plot. Two hundredweight of basic super gave an increase of 9 lb. over control, while the 1 cwt. superphosphate plot and 1 cwt. basic super plot both gave a minus result.

Though the value of basic super containing rock phosphate and lime in localities having a high rainfall is appreciated, it appears that under Canterbury conditions the soluble superphosphate gives quicker and more economical results. The idea prevalent among farmers in Canterbury that the constant use of superphosphate results in increasing soil-acidity cannot be said to be well founded. The amount of free acid present in 1 cwt. of super is so small that it may well be disregarded. Soils of an acid nature can be improved by more thorough tillage and the periodical application of lime, followed by superphosphate supplied with the crop.

TURNIPS.

An extensive test is being conducted on turnips, using proprietary mixtures, superphosphate, and basic super in varying quantities, with a cross-application of potash and nitrogen on a part of the area. The soil in this case is of a light loamy nature with a low moisture-content. The most striking feature of these experiments has been that with either superphosphate or basic super, applied at the rate of 2 cwt. per acre in contact with the seed, germination was adversely affected. The same applied in the case of 1 cwt. of the same fertilizers, though to a lesser degree. This action was possibly due to the ground being rather dry at the time of sowing. In the case of the proprietary mixtures germination was all that could be desired and subsequent growth good. A cross-application of potash and ammonium sulphate has made no marked difference up to the present.

MANGOLDS.

An experiment carried out on mangolds has probably shown more clearly than any other the phosphate-requirements of certain Canterbury soils. This particular crop was grown in soil which some years ago grew good roots, but of recent years has given disappointing results. The fertilizers applied were as follows: (1) Complete mixture; (2) phosphate and potash; (3) phosphates and nitrogen; (4) potash and nitrogen; (5) control; (6) superphosphate alone; (7) potash alone; (8) nitrogen alone. The rows which received superphosphate alone have stood out right through, no other plot in any way approaching them. Fig. 4 clearly demonstrates the point, reading from left to right in the order given — double rows for each manuring and a single row for the control.

HERD-TESTING ASSOCIATIONS.

DOMINION LIST FOR SEASON 1922–23.

W. M. SINGLETON, Director of the Dairy Division.

RETURNS showing the number of cows being tested under the association system in New Zealand during the season 1922–23 are now practically complete. Since the publication of the estimated totals in the March *Journal* the aggregate has risen to 83,605 cows, of which 34,558 are in associations controlled by the Dairy Division and 49,047 in privately controlled associations. The following list gives particulars and shows how the movement is represented in various parts of the Dominion:—

Associations controlled by Dairy Division.

Name of Testing Association.	Principal Dairy Companies which Members supply.	Number of Cows.
Alton	Alton Co-operative Dairy Company, Ltd. ..	234
Aria	Aria Co-operative Dairy Company, Ltd. ..	653
Awatuna ..	Awatuna Co-operative Dairy Company, Ltd. ..	690
Bull's	Rangitikei Co-operative Dairy Company, Ltd. ..	145
Bunnythorpe ..	Glaxo Manufacturing Company (N.Z.), Ltd. ..	611
Cheltenham ..	Cheltenham Co-operative Dairy Company, Ltd.	1,311
Dunedin ..	Waitaki Dairy Company, Ltd.	94
Eltham ..	Eltham Co-operative Dairy Company, Ltd. ..	1,292
Hauraki Plains ..	Hauraki Plains Co-operative Dairy Company, Ltd.	319
Hawera ..	Hawera Co-operative Dairy Company, Ltd. ..	790
Heretaunga ..	Heretaunga Co-operative Dairy Company, Ltd.	231
Hikurangi ..	Hikurangi Co-operative Dairy Company, Ltd. ..	1,465
Hokianga ..	Hokianga Co-operative Dairy Company, Ltd. ..	1,456
Horsham Downs	Horsham Downs Co-operative Dairy Co., Ltd. ..	228
T. L. Joll ..	T. L. Joll Co-operative Dairy Company, Ltd. ..	2,500
Kaipara ..	Kaipara Co-operative Dairy Company, Ltd. ..	2,100
Kairanga ..	Kairanga, Whakaronga, and Newsbury Co-operative Dairy Companies, Ltd.	462
Kaitieke ..	Kaitieke Co-operative Dairy Company, Ltd. ..	2,903
Kaponga ..	Kaponga Co-operative Dairy Company, Ltd. ..	272
Kaupokonui ..	Kaupokonui Co-operative Dairy Company, Ltd.	1,971
Kennington ..	Kennington Co-operative Dairy Company, Ltd.	130
Kia Ora ..	Kia Ora Co-operative Dairy Company, Ltd. ..	1,061
Kuku	Kuku Co-operative Dairy Company, Ltd. ..	130
Levin	Levin Co-operative Dairy Company, Ltd. ..	657
Lowgarth ..	Lowgarth Co-operative Dairy Company, Ltd. ..	177
Maketawa ..	Maketawa Co-operative Dairy Company, Ltd. ..	250
Makowhai ..	Glen Oroua Co-operative Dairy Company, Ltd.	338
Mangahao ..	Mangahao Co-operative Dairy Company, Ltd. ..	241
Mangatoki ..	Mangatoki Co-operative Dairy Company, Ltd. ..	411
Maungatapere ..	Maungatapere Co-operative Dairy Company, Ltd.	506
Mells	Mells Co-operative Dairy Company, Ltd. ..	204
Melrose ..	Melrose Co-operative Dairy Company, Ltd. ..	486
Ngaere	Ngaere Co-operative Dairy Company, Ltd. ..	696
Normanby ..	Normanby Co-operative Dairy Company, Ltd. ..	69
North Canterbury	Canterbury Central, Cam, and Tai Tapu Co-operative Dairy Companies, Ltd.; Avon, Mid-Canterbury, and Kiwi Dairy Companies, Ltd.; and Sefton Mutual Dairy Produce Assn., Ltd.	786

Associations controlled by Dairy Division—continued.

Name of Testing Association.	Principal Dairy Companies which Members supply.	Number of Cows.
Okitu	Okitu Dairy Factory	162
Okoia	Okoia Co-operative Dairy Company, Ltd. ..	496
Omata	Omata Co-operative Dairy Company, Ltd. ..	162
Opotiki ..	Opotiki Co-operative Dairy Company, Ltd. ..	747
Ormondville ..	Ormondville and Norsewood Co-operative Dairy Companies, Ltd.	362
Owaka	Stirling, Fairfield, and Owaka Co-operative Dairy Companies, Ltd.; and Clutha and Waitaki Dairy Companies, Ltd.	305
Perger	Waitara Co-operative Dairy Company, Ltd. ..	13
Pihama.. ..	Pihama Co-operative Dairy Company, Ltd. ..	606
Piopio	Piopio Co-operative Dairy Company, Ltd. ..	1,066
Riverbank ..	Riverbank Co-operative Dairy Company, Ltd. ..	26
Riverdale ..	Riverdale Co-operative Dairy Company, Ltd. ..	513
Shannon ..	Shannon Co-operative Dairy Company, Ltd. ..	216
Tariki	Tariki Co-operative Dairy Company, Ltd. ..	295
Te Rehunga ..	Tamaki Co-operative Dairy Company, Ltd. ..	280
Tokomaru ..	Tokomaru Co-operative Dairy Company, Ltd. ..	421
Tolaga Bay ..	Tolaga Bay Co-operative Dairy Company, Ltd.	349
United	United Co-operative Dairy Company, Ltd. ..	118
Uruti	Uruti Co-operative Dairy Company, Ltd. ..	418
Wangaehu ..	Wangaehu Co-operative Dairy Company, Ltd. ..	463
Whangarei ..	Whangarei Co-operative Dairy Company, Ltd.	1,227
Westmere ..	Westmere Co-operative Dairy Company, Ltd. ..	266
Woodville ..	Woodville Co-operative Dairy Company, Ltd. ..	178
	Total for 57 associations	34,558

Associations privately controlled..

Ballance Valley ..	Ballance Valley Co-operative Dairy Company, Ltd.	22
Bell Block ..	Bell Block Co-operative Dairy Company, Ltd. ..	533
Carrington ..	Carrington Co-operative Dairy Company, Ltd. ..	55
Clevedon ..	N.Z. Co-operative Dairy Company, Ltd. ..	500
Dalefield ..	Dalefield Co-operative Dairy Company, Ltd. ..	192
Featherston ..	Featherston Co-operative Dairy Company, Ltd.	135
Frankton No. 1 ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,200
Frankton No. 2 ..	N.Z. Co-operative Dairy Company, Ltd. ..	800
Glen Oroua ..	Glen Oroua Co-operative Dairy Company, Ltd.	120
Glyn	Glyn Co-operative Dairy Company, Ltd. ..	24
Herekino ..	Herekino Co-operative Dairy Company, Ltd. ..	24
Hopelands ..	Hopelands Co-operative Dairy Company, Ltd. ..	135
Horsham Downs	Horsham Downs Co-operative Dairy Co., Ltd...	24
Kaitaia ..	Kaitaia Co-operative Dairy Company, Ltd. ..	514
Kaituna ..	Kaituna Co-operative Dairy Company, Ltd. ..	428
Katikati ..	Katikati Co-operative Dairy Company, Ltd. ..	800
Kokatau ..	Kokatau Co-operative Dairy Company, Ltd. ..	35
Linkwater ..	Linkwater Co-operative Dairy Company, Ltd. ..	105
Little Akaloa ..	Little Akaloa Co-operative Dairy Company, Ltd	105
Maharahara ..	Maharahara Co-operative Dairy Company, Ltd.	80
Mangorei ..	Mangorei Co-operative Dairy Company, Ltd. ..	337
Marakopa ..	Marakopa Co-operative Dairy Company, Ltd. ..	60
Masterton ..	Masterton Co-operative Dairy Company, Ltd. ..	36
Matakana ..	Matakana Co-operative Dairy Company, Ltd. ..	50
Matahiwi ..	Matahiwi Dairy Factory, Ltd.	26
Matangi ..	Glaxo Manufacturing Company (N.Z.), Ltd. ..	200
Maungaturoto ..	Maungaturoto Co-operative Dairy Company, Ltd.	950
Mercury Bay ..	Mercury Bay Co-operative Dairy Company, Ltd.	265

Associations privately controlled—continued.

Name of Testing Association.	Principal Dairy Companies which Members supply.	Number of Cows.
Midhirst ..	Midhirst Co-operative Dairy Company, Ltd. ..	187
Ngaruawahia ..	N.Z. Co-operative Dairy Company, Ltd. ..	800
Ngatea	N.Z. Co-operative Dairy Company, Ltd. ..	1,700
Norfolk ..	Norfolk and Tatua Co-op. Dairy Companies, Ltd.	1,776
Norsewood ..	Norsewood Co-operative Dairy Company, Ltd.	80
Northern Wairoa	Northern Wairoa Co-operative Dairy Co., Ltd. ..	2,175
Okato	Okato Co-operative Dairy Company, Ltd. ..	390
Oroua Downs ..	Oroua Downs Co-operative Dairy Company, Ltd.	150
Oruru-Fairburn ..	Oruru-Fairburn Co-operative Dairy Co., Ltd. ..	828
Otago Central ..	Otago Central Co-operative Dairy Company, Ltd.	100
Otorohanga ..	N.Z. Co-operative Dairy Company, Ltd. ..	2,000
Paeroa	N.Z. Co-operative Dairy Company, Ltd. ..	1,700
Paraparaumu ..	Paraparaumu Co-operative Dairy Company, Ltd.	20
Parkvale ..	Parkvale Co-operative Dairy Company, Ltd. ..	168
Pembroke ..	Pembroke Co-operative Dairy Company, Ltd. ..	147
Port Albert ..	Port Albert Co-operative Dairy Company, Ltd.	355
Pukekohe ..	N.Z. Co-operative Dairy Company, Ltd. ..	2,000
Raglan	Raglan Co-operative Dairy Company, Ltd. ..	250
Rangitaiki Plains	Rangitaiki Plains Co-operative Dairy Co., Ltd.	275
Rapanui ..	Rapanui Co-operative Dairy Company, Ltd. ..	100
Rata	Rata Co-operative Dairy Company, Ltd. ..	2,177
Rongokokako ..	Rongokokako Co-operative Dairy Company, Ltd.	21
Rotorua ..	Rotorua Co-operative Dairy Company, Ltd. ..	150
Royal Oak ..	Royal Oak Co-operative Dairy Company, Ltd.	294
Stratford ..	Stratford Co-operative Dairy Company, Ltd. ..	530
Taikorea ..	Taikorea Co-operative Dairy Company, Ltd. ..	52
Taratahi ..	Taratahi Co-operative Dairy Company, Ltd. ..	300
Tataramoa ..	Tataramoa Co-operative Dairy Company, Ltd.	39
Tauranga ..	Tauranga Co-operative Dairy Company, Ltd. ..	800
Te Aroha West ..	Glaxo Manufacturing Company (N.Z.), Ltd. ..	700
Te Awamutu ..	Kakepuku Co-operative Dairy Company, Ltd. ..	1,300
Te Horo ..	Te Horo Co-operative Dairy Company, Ltd. ..	15
Te Poi	Sunny Park Co-operative Dairy Company, Ltd.	340
Te Puke ..	Bay of Plenty Co-operative Dairy Company, Ltd.	1,450
Tikorangi ..	Tikorangi Co-operative Dairy Company, Ltd. ..	618
Tiratu	Tiratu Co-operative Dairy Company, Ltd. ..	40
Tuakau.. ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,500
Waharoa ..	N.Z. Co-operative Dairy Company, Ltd. ..	2,500
Waiaruhe ..	Waiaruhe Co-operative Dairy Company, Ltd. ..	60
Waihou ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,000
Waikato Farmers' Union	N.Z. Co-operative Dairy Company, Ltd., at Te Rapa, Te Kowhai, and Orini Factories, and others	7,500
Waikato Valley ..	Waikato Valley Dairy Company	150
Waimate ..	Waimate Co-operative Dairy Company, Ltd. ..	509
Waipu	Waipu Co-operative Dairy Company, Ltd. ..	48
Wairoa ..	Wairoa Co-operative Dairy Company, Ltd. ..	100
Waitanguru ..	Waitanguru Co-operative Dairy Company, Ltd.	197
Waitemata ..	Waitemata Co-operative Dairy Company, Ltd.	151
Waitoa ..	N.Z. Co-operative Dairy Company, Ltd. ..	700
Waiuku ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,600
Wanganui Fresh Food	Wanganui Fresh Food and Ice Company, Ltd. ..	250
Whangaroa ..	Whangaroa Co-operative Dairy Company, Ltd.	500
Whenuakura ..	Whenuakura Co-operative Dairy Company, Ltd.	500
	Total for 80 associations	49,047

A marked feature of these lists is the small number of cows under association test in the South Island, the total being 2,134. It is recognized, of course, that much of the South Island is devoted more particularly to branches of farming other than dairying; nevertheless, the number quoted cannot be accepted as a satisfactory proportion of its dairy cows. It is hoped that South Island dairy-farmers will increasingly realize the value of testing, and that next season will evidence a marked development. The number of dairy cows in the South Island totals 274,372, and 2,134 is only 0·78 per cent. of this, while 83,605 is 7·35 per cent. of the total number of dairy cows in New Zealand (1,137,055).

IMPORTATION OF FERTILIZERS, 1922-23.

ANNUAL STATISTICS AND REVIEW.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1923, are now (by the courtesy of the Comptroller of Customs) available, and, together with other data, have been specially compiled for the *Journal* in the accompanying tables.

PHOSPHATIC FERTILIZERS.

Referring to bone products one notices, without any fear of the result, that the amount of bonedust coming into this country continues to decrease. The quantity of bone manures imported during the twelve months is reduced to one-half of the previous year's figures.

The figures for basic slag show an increase of some 6,000 tons. The importation of slag from the United States is being continued, some 6,500 tons coming from that country.

Rock phosphate and guano show an increase of 24,000 tons, which is the best feature of the year. Of the total of 69,591 tons it is satisfactory to notice that 51,000 tons came from Nauru and Ocean Islands, and that if the high phosphate-content of this product is taken into account it will be found that the figures disclose a record for the amount of phosphoric acid imported for manurial purposes during any year. Although the actual tonnage of phosphate imported was less than that of 1921 (the year which holds the record up to the present) the content of phosphoric acid is so much greater that under "rock phosphate and guano" it is estimated that some 3,600 tons more of phosphoric acid was imported in 1923 than in 1921. This amount is chemically equal to the phosphoric acid contained in, say, 21,000 tons of basic slag. Possibly there is no single substance upon which the agricultural prosperity of the North Island is so dependent as phosphoric acid combined in one of the phosphates of lime, and the fact that in hard times such a record had been achieved must be considered extremely satisfactory.

NITROGENOUS AND POTASSIC MANURES; GYPSUM.

Importations of nitrogenous manures show a decrease for the year. Their correct place in the system of manuring in New Zealand has yet to be determined. The figures for potassic compounds are roughly double those of the previous year. Gypsum (hydrated sulphate of lime) is again coming in greater quantities, no doubt to be largely used as a diluent, of which it is one of the best.

SUMMARY OF KINDS, QUANTITIES, AND DECLARED VALUES OF FERTILIZERS IMPORTED DURING YEARS ENDED 31ST MARCH, 1922–23 AND 1921–22.

Fertilizer.	Quantity.		Value.	
	Year 1922–23.	Year 1921–22.	Year 1922–23.	Year 1921–22.
	Tons.	Tons.	£	£
Bonedust	2,446	4,063	24,205	46,981
Bone char	215	594	1,797	4,004
Blood-and-bone	..	50	..	707
Basic slag	19,641	13,488	82,732	83,539
Superphosphate	..	3,140	..	21,906
Rock phosphate (raw) and guano	69,591	45,956	124,672	103,245
Kainit	3,894		10,481	
Muriate of potash	60		627	
Sulphate of potash	592	2,420	6,868	16,660
Potash, other	670		3,270	
Gypsum	1,493	301	2,398	507
Sulphate of ammonia	436	2,058	7,420	28,846
Nitrate of soda	386	204	5,426	3,920
Sulphate of iron	53	26	606	286
Manures unspecified	6	..	286	77
Totals	99,483	72,300	270,788	310,678

NOTE.—With regard to the "declared values" given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not cover the present freight, insurance, and other charges, the statistical value is less than the actual landed value."

IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS FROM 1913 TO 1923.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Guano and Rock Phosphate.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons
1913	9,281	20,133	32,964	25,033	Nil.
1914	6,578	30,350	41,582	22,093	,,
1915	7,966	29,385	54,190	23,983	,,
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	,,

IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1923, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.			Chile.	India.	United States of America.		Pacific and Indian Ocean Islands.		United Kingdom.			Belgium.		France.		Germany.		Netherlands.	Luxemburg.
	Nitrogenous Manures.	Bonedust.	Gypsum.	Nitrogenous Manures.	Bonedust.	Nitrogenous Manures.	Basic Slag.	Name of Island.	Rock Phosphate.	Nitrogenous Manures.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Basic Slag.
Auckland ..	80	1,681	1,491	116	750	205	3,250	New Caledonia	2,929	191	3,106	70	6,592	355	..	500	..	2,002	20	150
								Nauru ..	18,737											
								Ocean ..	20,203											
								Seychelles ..	1,098											
New Plymouth ..	..	205	..	..	..	..	2,300	New Caledonia	500	..	1,000	..	300	..	..	10	..	140	..	..
Wellington ..	20	5	..	..	..	..	961	New Caledonia	315	..	1,150	205	520	25	80	398	100	175	60	..
Napier ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35	..	..	..	..
Lyttelton ..	..	..	..	75	..	..	..	Nauru ..	8,828	25	..	10	25	..	..	472	..	125	..	..
Timaru ..	..	..	..	..	..	..	..	New Caledonia	931											
								New Caledonia	299	..	..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	10	..	40	..	..	..	Nauru ..	4,381	..	..	55	25	..	..	454	..	185	..	..
								Seychelles ..	700											
								New Caledonia	255											
								Malden ..	1,415											
Invercargill ..	..	..	..	..	..	..	..	New Caledonia	1,425											
								Seychelles ..	3,222											
								Tuamotu ..	4,300											

NOTES.—Nauru and Ocean Islands are operated jointly by the British Phosphate Commission. For the previous year's corresponding statistics see *Journal* of May, 1922.

SUPERPHOSPHATE AND THE IMPORTATION OF SULPHUR.

The outstanding feature of the year's statistics is the total absence of superphosphate importations. This must be accounted a very favourable symptom when the cause is known to be that all the superphosphate required is now manufactured in the Dominion, the raw material, except small quantities of sulphur and phosphates locally produced, being obtained from overseas. The fact that New Zealand manufacturers are now able to cope with all internal demands for this valuable artificial phosphate, involving the employ of highly trained chemists and costly plant and machinery, is important from another point of view. The manufacture of superphosphate necessitates the making of sulphuric acid, as it cannot conveniently be imported. The establishment of a superphosphate industry on a large scale is therefore bound to stimulate the manufacture of sulphuric acid. The use of sulphuric acid in manufactures is so general that the amount of it consumed is some indication of a country's industrial development. (Over 5,500,000 tons, worth 10,500,000 dollars, were produced in the United States in 1920.) Superphosphate-making in New Zealand, by stimulating the production of sulphuric acid, is therefore also likely to be of assistance to other industries.

The importation of sulphur into New Zealand is so important from a fertilizer point of view that it is desirable to deal with the subject in this review The following table shows the importations since 1902 :—

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
	Tons.		Tons.		Tons.
1902 ..	283	1909 ..	1,308	1916 ..	2,444
1903 ..	549	1910 ..	1,599	1917 ..	1,861
1904 ..	747	1911 ..	1,264	1918 ..	3,080
1905 ..	416	1912 ..	2,593	1919 ..	3,234
1906 ..	1,183	1913 ..	1,925	1920 ..	4,165
1907 ..	339	1914 ..	114	1921 ..	4,622
1908 ..	1,607	1915 ..	1,714	1922 ..	9,035

Yearly average 1902–11, 930 tons; yearly average 1912–22, 3,162 tons.

In the past the great bulk of this sulphur has been obtained from Sicily and Japan, the small quantities mined in the thermal district of the North Island being quite inadequate to fill the local demand. During 1922 8,500 tons of sulphur was imported from the United States, a fact which brings New Zealand manufacturers into economic touch with an industry—the sulphur-mining of Louisiana—the story of which is one of the most romantic in the history of industrial enterprise

In 1865 petroleum-boring operations in Louisiana disclosed the presence of a sulphur deposit beneath a layer of quicksand about 500 ft. thick. A good deal of money was lost in legal actions before a decision could be reached as to whether the right to exploit petroleum included the right to mine sulphur; but the losers in the action were more fortunate than those who established their right to the sulphur, for the latter lost more money in trying to bring the sulphur to the surface. In fact, the deposit brought misfortune to all who up to this time

attempted to work it. An Austrian company, a French company, and numerous American companies failed, and not a ton of sulphur was produced. The solution of this extraordinary problem in mining of how to bring to the surface from anything up to 1,000 ft. below it a deposit of solid pure sulphur (melting-point 292° F.) which was covered by layers of quicksand and limestone rock was finally solved by Herman Frasch, one of the greatest of American chemical engineers. In 1891 he became interested in the problem, which had cost some their lives and others their money, while all were baffled. At this time the sulphur demands of the world were supplied from Sicily and Japan. In both countries labour was cheap, the Sicilian receiving about 2s. 6d. a day, whereas American miners required 5 dollars at least; but the question of wages was one of the smallest troubles to be surmounted. The difficulties of drilling through quicksand to determine finally the character of the deposit were sufficiently tedious, taking from six to nine months to do what could be done in as many days with ordinary rock. The engineer had previously decided that the only way—an entirely novel one—to mine this sulphur was to melt it in the ground and pump it on to the surface in the form of a liquid. The melting-fluid consisted of water superheated to 335° F. in columns in which 100 lb. per square inch pressure was maintained, and which was sent down to the deposit through a specially constructed double pipe, the pressure forcing the melted sulphur up through the inner pipe.

After the initial demonstration of the success of this method it was not until 1903, or some twelve years later, that all the difficulties had been surmounted and the proprietors could see financial success ahead. In that year was produced 122,000 tons of pure sulphur, which was more than the consumption for the whole world for one year at that date. Of the subsequent success which attended this enterprise it is sufficient to say that in 1912 the average output of sulphur from the mine was 250,000 tons of sulphur guaranteed 99·5 per cent. purity, and it is stated that the only limitation of output is the market demand. The industry now entails that enormous quantities of water should be superheated in about 160 boilers of a total capacity of 25,000 horse-power. As the sulphur flows up it is pumped into movable bins. As the deposit on the surface grows in thickness, cools, and solidifies, the sides of the bins are raised. Blocks of pure sulphur are thus formed which weigh thousands of tons. The sulphur is blasted away from these blocks and loaded into trucks by machinery capable of loading a 35-ton truck in fourteen minutes. The sulphur is railed to Sabine, a port in southern Texas, where it is possible to load a 7,500-ton steamer within twelve hours.

The sulphur produced in 1921 in the United States amounted to 1,879,150 long tons, about one-third more than was produced in 1920. The shipments were one-third less than in 1920. It would therefore appear that large stocks are now on hand and available for export to New Zealand or any other country which can absorb the surplus. In 1920 and in 1921, as in former years, 99·5 per cent. of the sulphur produced in the United States came from the deposits in Texas and Louisiana.

New Rabbit District.—The Cheltenham Rabbit District (Wellington) has been constituted for the purposes of Part III of the Rabbit Nuisance Amendment Act, 1918.

LIMING FOR WESTLAND SOILS.

TESTS AT WAIMAUNGA EXPERIMENTAL FARM.

C. S. DALGLIESH, Fields Instructor, Hokitika.

ANALYSES of South Island West Coast soils show that their lime-requirement in carbonate of lime ranges from 1 ton to 6 tons per acre. The practical experiences of many farmers and the results of work carried out by the Department of Agriculture at Waimaunga Experimental Farm and in other local districts clearly demonstrate that liming is the basic principle of agriculture on this coast, and that only a meagre amount of cultivation can be undertaken without its use.

Waimaunga Farm soils show a lime-deficiency of 2 tons to 3 tons per acre. This farm is situated in the northern end of Grey Valley, thirteen miles south of Reefton. The land brought under cultivation since the Department took possession is light, and very fairly representative of the lighter lands of the West Coast. The grassland mainly consisted of fiorin and sweet vernal, there being a complete absence of clovers and the better-class grasses. The capacity of such pastures, either for stock-raising or milk-production, is very low. Subsequent to the breaking-in of the land by previous owners of the property good crops of oats and turnips were grown, but the better grasses did not hold for any length of time, and clovers never did thrive.

Field 1 at Waimaunga—light, shallow land, stony in places—was ploughed in the winter of 1921, cultivated in the spring, and given 1 ton of ground burnt lime per acre. The area was sown in temporary pasture of rye-grass and clovers in November, 2 cwt. of superphosphate per acre being used as a manure. An excellent pasture resulted, with clovers prolific. The field was grazed with stock from January to the beginning of September, 1922, and then closed up to the end of October. From 31st October to 14th November it carried store bullocks at the rate of one per acre; from then to the last day of November it carried two bullocks per acre. It was then spelled with the intention of again stocking in three weeks' time, but plenty of other feed being available it was not until 14th January last that stock was again put on. There was a great growth of feed—an ideal clover-hay crop. From then to the middle of February the field was heavily stocked with store bullocks and sheep, then given three weeks' spell; it has carried since six sheep per acre and more than held its own.

Field 2 was ploughed in January, 1921, cultivated during February and March, and limed at the rate of 2 tons per acre, with the exception of a strip 1 chain in width lengthwise through the field, this being left unlimed. The field was thus left during the winter; in the spring it received light cultivation and was again ploughed, and 4½ acres made ready and sown in root crops in December, the remainder of the field being fallowed. The crops grown were swedes, turnips, and carrots, also Thousand-headed kale. Ten days previous to these crops being sown, purely as an experiment, an additional 12 cwt. of lime per acre

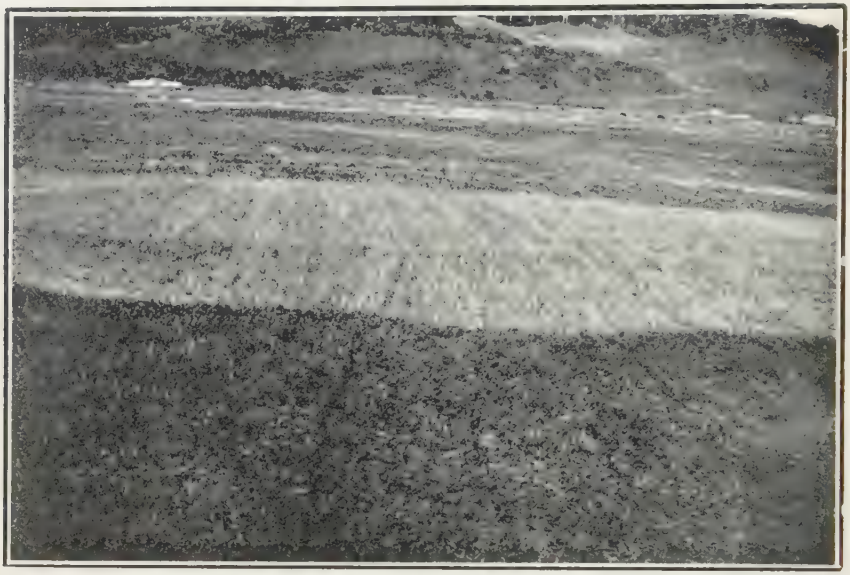

FIG. 1. FIELD 2 AT WAIMAUNGA EXPERIMENTAL FARM, SHOWING CONDITION OF TEMPORARY PASTURE ON LIMED AND UNLIMED LAND.

This photo was taken three weeks after harvesting of the oat crop. The light-coloured area in centre is the unlimed strip, the clover growth showing dark on the limed land on both sides.

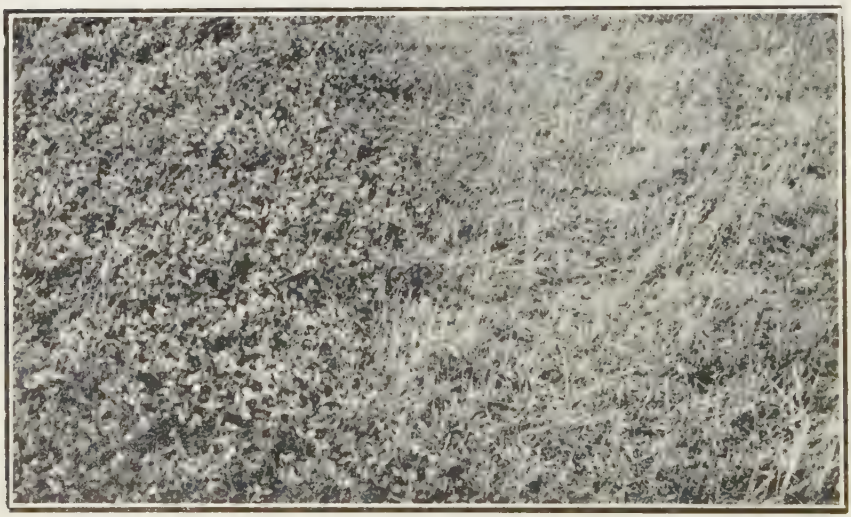

FIG. 2. CLOSER VIEW OF THE TEMPORARY PASTURE IN FIELD 2.

Showing (to right) the stubble of the oat crop and poor pasture on the unlimed strip, and good clover-growth (to left) on limed area.

was applied to a certain area on each side of the field. The manure used was 2 cwt. superphosphate per acre.

The root crops gave the following average yields per acre :—

Crops.	2 Tons Lime in Autumn.		2 Tons Lime in Autumn with 12 Cwt. additional previous to Sowing.		No Lime.	
	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.
Swedes	25	13	30	9	10	11
Turnips	23	7	26	0	14	3½

The carrots were a poor crop all through, being sown rather late to ensure a good result, and a complete failure on the unlimed land. The Thousand-headed kale gave a very fair crop on the limed areas, but there was a complete absence of plants on the unlimed land.

The root crops were fed off with stock during the winter, and the land ploughed in the spring. With the exception of 2 acres reserved for swede manurial trials, the field was sown in Algerian oats and temporary pasture of Italian rye-grass and cow-grass. A proprietary fertilizer was used at the rate of 2 cwt. per acre ; a strip ½ chain in width running across the field was left without manure. From the commencement of growth the oats on the unlimed strip lagged far behind, being poor and yellow in colour in the early stages of growth and finishing as a very poor crop indeed. The unmanured part showed a very backward growth for the first five to six weeks ; after that it came on remarkably well, but at time of harvest was of shorter growth and gave a smaller yield than did the manured area. The yields of chaff per acre were as follows : Limed and manured area, 37 cwt. ; limed, without manure, 32 cwt. ; unlimed, with manure, 9 cwt. ; unlimed, and no manure, 7 cwt.

The temporary pasture made great growth on all but the unlimed strip, and on the lighter parts of the field seemed to retard the growth of the oat crop. On the unlimed part the pasture is extremely poor—in fact, can scarcely be termed a pasture, the grass sown being thin and weak, and the clover sparse and yellow in appearance. The line of difference in growth between the limed and unlimed land is strongly defined, as shown by Figs. 1 and 2.

The 2 acres reserved for swede manurial trials in this same field was sown with Superlative in the second week of December, and twenty different manures given a trial. The results have been a failure on the unlimed part, swedes failing to braird on many plots and very poorly on others, with subsequent stunted growth. Phosphatic manures gave the best braird ; basic slag gave much the best result on the unlimed land ; the nitrogenous manure plots were slow to start growth, and a complete failure on the unlimed land. Fig. 3 shows the scanty growth of swedes on the unlimed part as against a fair growth on the limed area.

Field 3 was sown in permanent pasture in the autumn of 1922, with 2 cwt. superphosphate per acre. Half of the field had received 1 ton of lime per acre and the other half 2 tons during the previous late winter and early spring when in preparation to be sown in oats

and vetches and oats and peas; the manure for the latter crops being 2 cwt. per acre of one part superphosphate and one part Ephos phosphate. Very heavy crops of oats and vetches, and oats and peas, were secured. The pasture is excellent, with a good sole of clovers, and is carrying stock well. Both parts of the field—1 ton and 2 tons of lime respectively—have given equally good results.

Field 4 was sown in pasture in February, 1921, 2 tons of lime per acre being applied during preparatory cultivation operations. Manure, 1 part superphosphate and 2 parts Ephos phosphate, was applied at 2 cwt. per acre. This is now a first-class pasture, carrying stock well. A very good crop of clover hay, averaging 2 tons per acre, was harvested in January, 1922.

Field 5 differs in formation from the major portion of the farm, being of river-flat formation of a free sandy nature. This field was

FIG. 3. SWEDE CROP IN FIELD 2, SEASON 1922–23.

Showing failure of swedes on unlimed land (to right) and fair growth on limed ground (to left).

cleared of gorse and blackberry, ploughed in late autumn and winter, and part sown in a broadcast swede crop in December. The greater part received a second ploughing in preparing the land for the crop. The field, with the exception of a strip 1 chain in width in the centre, received an application of 5 cwt. of lime per acre, and was manured with 1 cwt. bonedust per acre. The crop was only medium. The braird was very much poorer and growth stunted on the unlimed in comparison with the limed portions.

Field 7 was ploughed in the winter of 1921, preparatory to being sown in oats. It was intended that one-half of the field be limed at the rate of 1 ton per acre and the remainder be not limed. Owing to the full quantity not being available when required only a few acres

received the application of lime. Dun oats were sown in the spring with 2 cwt. of superphosphate as a manure. A very fair crop resulted, being better on the limed portion, with stronger growth.

This field has not been ploughed since, and has reverted to a fiorin and sweet-vernal pasture. The striking and prominent feature of this natural succession is the growth of superior pasture-plants on the few acres which were limed, also its preferential treatment by stock, both facts emphasizing the great value of lime for such soils. These few acres are carrying what can be termed a good second-class pasture (white clover, Lotus major, and a fair proportion of rye-grass), which is kept closely grazed down by stock. It also carries a vigorous growth of Scotch thistles. The remainder of the field is comprised of a fiorin and sweet-vernal pasture in full seed (at time of writing), not being relished by stock. There is also an absence of thistles.

An account of liming and manurial experiments in other districts of the West Coast will follow.

CONTROL OF PROPRIETARY STOCK-FOODS.

LEGISLATIVE MEASURES IN OTHER COUNTRIES.

COMPLAINTS have been received from time to time by the Department regarding proprietary stock-foods and condiments on the local market. There are, of course, many good genuine stock-foods on the market, but close examination has proved other preparations to consist more or less of cheap ingredients having little or no nutritive value, while in one instance analysis of a certain proprietary mixture, prompted by the ill effects which followed its consumption by pigs, showed it to contain substances actually poisonous.

For the information of farmers and others, summaries of legislative measures adopted by certain other countries in dealing with this matter have been prepared and are here presented. The chief points suggested are that all proprietary live-stock and poultry foods, condiments, and tonics should be registered; and that an invoice certificate showing the composition and food value of the preparation, as determined by analysis, be made the basis of every sale—the vendor being liable to penalty if the article proves to be below the standard indicated in the invoice. This would put the sale of stock-foods on an equal footing with the sale of fertilizers, and would afford the farmer the same protection as he now enjoys in respect of the latter.

THE QUEENSLAND LAW.

Queensland possesses a very complete measure for the control of stock-foods, as apart from purely medicinal preparations, in the Stock Foods Act of 1919. This statute covers foods for horses, mules, asses, cattle, sheep, goats, pigs, dogs, domestic fowls, turkeys, geese, ducks, pigeons, and birds in captivity, these being divided into three classes —namely, mixed concentrated or prepared stock-foods, comprising foods

or meals prepared from one or more than one kind of grain, or from oils, juices, meats, or other sources, and condimental foods having nutritive as well as medicinal properties; by-products, such as bran, pollard, brewers' grains, and materials produced from any kind of grain or seed in any process of manufacture, not being the primary object of such process; and fodders, such as hay, straw, chaff, &c.

In the case of prepared stock-foods and such by-products as are prescribed in regulations under the Act, the person primarily responsible for their being placed on the market must, before selling, and annually thereafter, forward to the Under-Secretary, Department of Agriculture and Stock, Brisbane, samples of at least 2 lb. in weight of each such food. Each sample must be accompanied by (1) a statutory declaration stating that it is a fair average sample, and giving the specific name and proportion of each of the original grains, seeds, or other ingredients contained in it; and (2) a specimen copy of the invoice certificate, of all directions for use, and of the label to be affixed to every package of the food sold, showing the net weight of food, the name or trade-mark, the name and address of the principal seller, the chemical analysis of the food according to the method prescribed, and the specific name of each of the original ingredients. If at any time the composition of the food is varied, notice to that effect must immediately be given. Chemical analysis is not required for poultry-corn composed of whole grain only, nor for bird-seed.

Retail sellers repacking the food in smaller packages must affix to the latter a label showing all the particulars shown on the original label, together with the net weight of food in the package, and their own name and address, such label to be of a different colour from the original. Where such practice is adopted the onus is on the retail dealer to prove that the food in the smaller package is of the same composition as that in the original package.

Upon the sale of any stock-foods not required by the Act to be labelled, or on the request of the buyer in the case of labelled foods, the vendor must, within seven days of delivery, supply an invoice stating the quantities sold and the specific materials of which the food consists, such statement to act as a warranty that the food consists solely of the materials specified and in the proportions given; that it contains no greater amount of foreign ingredients than is allowable; that it is suitable for stock-food and for the kind of stock specified; and that the particulars regarding weights, &c., are correct.

As regards sales of mixed hays, straws, and chaffs, the Act provides that the invoice shall specify each component part of such mixed fodders, and that in the case of chaff each package of straw-chaff shall be distinctly marked with the letters SC, and each package of mixed hay and straw chaff with the letters MS.

Detailed instructions are laid down regarding the taking of samples, and provision is made for the appointment of officers with power to sample all stock-food sold, or exposed or prepared for sale, on paying the ordinary market price for the quantity taken. A purchaser may also take for analysis, within fourteen days of delivery, a sample of the stock-food supplied, provided he gives notice in writing of his intention to the vendor, in order that the latter may be present, should he so desire,

when the sample is taken. It is provided that wherever possible samples shall be taken in the presence of the seller or his agent, whose signature, together with that of the person taking the sample, must then be appended to the label on each sample.

Samples are divided into three parts and sealed, one being handed to the seller and the other two forwarded to the Under-Secretary of the Department of Agriculture and Stock for analysis. Where any deficiency or irregularity is disclosed, proceedings are taken against the vendor, on whom lies the onus of proving that no offence against the Act has been committed. A maximum penalty of six months' imprisonment and a fine of £100 is provided for, while a defrauded purchaser also retains the right of recovery by civil action.

Power is provided for the Governor in Council to make regulations under the Act prescribing those stock-foods and by-products to which the Act shall apply, the amount and character of foreign ingredients allowable in stock-foods, the forms and labels to be used, and fixing a fair average standard for any class of stock-food.

In connection with the administration of this Act, which has now been in force for three years, the Under-Secretary of the Queensland Department of Agriculture and Stock stated, when communicated with, that the difficulty experienced with regard to proprietary articles had been not so much the reluctance on the part of manufacturers to give the specific names of each of the materials used as the inability of some to fix a definite standard and make all food sold under a particular brand conform to the facts expressed in the statutory declaration. There was no doubt, however, that manufacturers had now standardized their methods, and were putting on the market an article of better value. Another good effect of the Act's operation was that several stock-foods for which exaggerated claims were being made had since disappeared from the market, while the accessibility of full particulars regarding composition had no doubt prevented other inferior preparations from being placed on sale.

LAW OF THE UNITED KINGDOM.

The English law on this subject is contained in the Fertilizers and Feeding-stuffs Act, 1906, and provides that the vendor of any artificially prepared stock-food shall give to the purchaser an invoice stating the name, ingredients, and the percentages of oils and albuminoids contained in it, such invoice to act as a warranty as to the facts so stated, except in so far as certain degrees of error are allowed as regards percentages. There is also an implied warranty that the preparation is suitable for the purpose for which it is sold. Should the name be such as to imply that the article has been prepared from one or more particular ingredients, without indication that others are compounded in it, the law presumes that it contains only the indicated substances. The vendor is not liable (1) if he did not know and could not with reasonable care have ascertained that the invoice was false, or (2) if he relied on an invoice given by a person in the United Kingdom. Where the food has been prepared under the detailed instructions of a purchaser, the vendor's certificate need only give the analyses of the component ingredients.

The various county and borough authorities are empowered to appoint analysts and samplers under the Act, the approval of the Ministry of Agriculture being required in respect of each appointment. A purchaser of stock-food may, on payment of a fee, accompanied by a sample and a copy of the invoice certificate, obtain from the local analyst an analysis of such sample. Should he contemplate legal proceedings, the sample must be taken within ten days after delivery of the consignment, and in accordance with the method laid down in regulations under the Act, or he may request the official sampler to take the sample. The latter may also take samples of any feeding-stuff sold or exposed for sale at his discretion. If analysis by the local analyst shows the food to be inferior to the guaranteed quality a second portion of the same sample is analysed by the Chief Analyst, and if this confirms the local analysis proceedings under the Act are instituted against the vendor, who is liable to a fine of £20 for a first offence and £50 for any subsequent breach. In addition, the purchaser prejudiced by the misdescription of the food is entitled to any civil remedy he may otherwise have had. Penalties are also provided for any other breach of the Act, and for any act tending to obstruct its operation.

UNITED STATES MEASURES.

In the United States of America each State makes its own laws governing the sale of stock-foods within its borders. It will be sufficient to instance the State of Iowa, where there are special laws regulating the sale of these products, the enforcement of which is in the hands of the State Dairy and Food Commissioner. This officer issues a license in respect of each condimental, patent, proprietary, or trade-mark stock-food, based upon an analysis for nutritive value, and carries out periodical analyses to ensure compliance with the law. He also analyses samples at the request of purchasers of stock-food, and will institute proceedings against the vendor if necessary. A feature of this administration is that the Commissioner will also assist a defrauded purchaser to obtain restitution to the extent of any deficiency, this service being given without charge.

Noxious Weeds.—The Mongonui County has declared Cape honeyflower, and the Inglewood County broom, foxglove, gorse, ox-eye daisy, pennyroyal, St. John's wort, spiderwort, and barberry, to be noxious weeds in the respective districts under their jurisdiction.

Ruakura Sale of Pedigree Stock.—The fourth annual sale at the Ruakura Farm of Instruction, held on 18th April, attracted a large attendance of buyers, and competition was good, very few lots being passed in. Twenty-three lots of Darbalara Milking Shorthorn bull calves realized an average of 33 guineas, Dominion Manilla of Ruakura and Dominion Might of Ruakura bringing the highest price, at 60 guineas each. Five Jersey bull calves were sold for 20 guineas each. Milking Shorthorn two- and three-year-old females (fifteen lots sold) averaged 30 guineas, the highest price received being for Dominion Moireen of Ruakura, at 60 guineas. For sixteen Berkshire boars sold the average price was 5½ guineas, and the highest price 11 guineas; while for twenty-three Berkshire sows the average was 8 guineas and the top figure 13½ guineas. Considering the present state of the live-stock market, the prices realized for such young animals were highly satisfactory. Most of the pigs offered ranged from four to five months old.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

II. THE BIRDS OF THE FOREST.

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At a time immeasurably remote—somewhere about the close of the Secondary era—New Zealand formed the south-western extension of a great continent stretching north to Fiji and New Guinea. In that far-distant period the portion which was to survive as New Zealand when all the remaining links sank beneath the surface of the ocean was colonized by most of its land-birds—or, rather, by most of the ancestors of the birds which were later to constitute the most extraordinary avine population on the face of the globe. The connecting-links sank—and through all the æons of the Tertiary era to, comparatively speaking, the present day New Zealand was cut off from the rest of the world.

At the time when New Zealand was last connected with larger land-masses mammals had either not yet been evolved from the common reptile-like stock from which our present lizards and snakes and the birds themselves have arisen, or else they had not yet reached a land by means of which they could spread to this country. The birds, then, were the highest evolved inhabitants of this isolated land. It was a heavily wooded country. The birds and the forest grew in beauty side by side: on their indissoluble interdependence, the importance of which has never hitherto been adequately realized, more emphasis will be laid later. Thus this ancient New Zealand was above all else a land of birds; no other land-mass so large has remained isolated so long, and in no other area of any considerable size have birds achieved terrestrial domination. Such an unusual state of affairs was certain to produce extraordinary results.

Of these consequences the one which forms the subject of the present article is that which concerns the relation of the indigenous land-birds to the forest; and we cannot sum up this relation better than in the words of Mr. L. MacIntosh Ellis, Director of the State Forest Service, who states that no other forest that he knows is so dependent on birds as that of New Zealand—in fact, "no birds, no forest."

The activities of birds in the forest may be discussed under three main headings: (1) Birds as the chief agents in keeping forest insect pests in check; (2) as pollinators of the flowers of forest-trees; (3) as distributors of the seeds of forest-trees, and thus as agents in the establishment of forest.

Now, whereas in New Zealand birds are extremely important factors in all these three respects, in the great pine-forests of the north of the Old and New Worlds practically their sole service is in the war against insect pests. The flowers of all the northern pines and of a

very large proportion of the deciduous forest-trees are pollinated by the wind, and the same agency is responsible for the carrying of the seed to new ground.

A visitor to New Zealand hitherto acquainted only with these great northern forests would be startled if, when his eyes fell for the first time on such remnants of forest as he would see in travelling by rail from Auckland to Wellington, he were told that from forests like these came the bulk of the commercial timbers of New Zealand. Nor would a close inspection of this type of forest—the "mixed bush" of the settler, the "rain forest" of the botanist—lessen his surprise. The great number of different kinds of trees and shrubs growing in association with one another, the tree-ferns, the perching plants high up on the limbs of the tall trees, and the network—in some places almost inpenetrable—of climbing plants would fill him with wonder. If he were interested in such things and saw again with his mind's eye the northern pine forests in their flowering season, the air dim with drifting pollen, and later filled with winged seeds fluttering away from their parent trees, he might well ask himself the question whether in these strangely different New Zealand forests there must not be other agencies at work besides that with which he was so familiar, the wind. How many of us, even of those who have spent their lives in the bush, could answer his question at all adequately? It would take years of careful research to find out in the case of each species of tree or shrub of the New Zealand forests exactly how pollination (transference of the male cell, or pollen-grain, from the anthers to the receptive female organ, or stigma) and dissemination (dispersal of the seeds) are brought about. All that is attempted in the present article is to collect some of the few facts that are known as to the part played by New Zealand forest-birds in pollination and dissemination, those two silent processes without which the forest would, if left to itself, dwindle day by day until at last it vanished utterly.

POLLINATION.

As regards New Zealand forests there are three agents by which pollination is effected—wind, insects, and birds. The total number of forest-plants in New Zealand is a large one, even when there are excluded from it all the ferns and their allies, and such trees and shrubs as from their rarity may be considered negligible. A list of this sort, which is of necessity a more or less arbitrary one, has been prepared by the writers, and from it has been obtained the following rough proportion of plants which fall under each of the headings just stated—namely, wind-pollinated, 40 per cent.; insect-pollinated, 47 per cent.; and bird-pollinated, 13 per cent.

These figures show that the bird-pollinated plants form but a small percentage of the whole, but, curiously enough, they include several most important timber-trees—the northern and southern ratas (*Metrosideros robusta* and *M. lucida*), the pohutukawa (*M. tomentosa*), the puriri (*Vitex lucens*), and the rewarewa or honeysuckle (*Knightia excelsa*). Insects no doubt play a part in the pollination of the ratas and pohutukawa, but the puriri, which is the most valuable hardwood in New Zealand, and the rewarewa, so well known and largely used as

an ornamental timber, appear to be absolutely dependent on birds for their pollination. The actual processes in the case of these two trees have been carefully investigated, the rewarewa having been studied by Mr. T. F. Cheeseman, and the puriri by Dr. D. Petrie.

Though the puriri has not as wide a distribution in nature as the rewarewa it is often cultivated and flowers when quite young, so that the visits of birds to the flowers may be easily observed. After describing the structure of the flower Dr. Petrie goes on to say: "Though the secretion of nectar is both abundant and long-continued, flying-insects do not frequent the flowers; and, indeed, the store of nectar is so carefully protected by the natural plug of matted hairs obstructing the corolla-tube that insects could reach it only by biting through the base of the corolla-tube, and this I have never known to occur. There is no doubt that pollination is effected exclusively by small birds. These constantly visit the flowers, hang on to the rigid leaf-stalks or flower-stalks, and insert their bills into the corolla-tube and suck the nectar. In sucking the sweet juice the tui may be seen grasping a flower in one foot and turning it round into a more convenient position. In passing from flower to flower the birds cannot avoid bringing pollen from young flowers to older ones and so effecting pollination."

Besides the valuable trees already mentioned as being dependent on birds for their pollination, there are several other small trees and shrubs which without the same agency would produce no fruit. Some, apart from anything else, are not of wide enough distribution to be considered in an article dealing with the forest in general; but there is one, the common fuchsia (*Fuchsia excorticata*), which is abundant in nearly every gully in the country and often extends far up their sides, where it is conspicuous in winter owing to its leafless habit and reddish branches. Every one well acquainted with the bush has seen the tui hanging head downwards on a fuchsia-branch thrusting its bill into the pendulous flowers in search of nectar. The rarer makomako, or bell-bird, with its much lighter-coloured plumage, often shows in the flowering season of the fuchsia a bright-blue stain on its head near the base of the bill, which is clear evidence of the part it too has been playing as a pollinator of the fuchsia.

Perhaps it may be asked why the fuchsia, which is of little commercial value, is included in an article seeking to show the value from a utilitarian standpoint of the birds of New Zealand. Nevertheless, the fuchsia, together with other small trees such as the mahoe (*Melicytus ramiflorus*), wineberry (*Aristotelia serrata*), and the "five-fingers" (*Nothopanax* spp.), which have bird-carried fruits, does play an important part in the regeneration of the New Zealand forests. It stabilizes the lower, often stony or clayey, slopes of many valleys which otherwise would suffer much from erosion, and by affording shelter to ferns and other small plants helps to form a seed-bed for the young plants of many timber-trees. Although it does not really come within the scope of the present article, the part played by the honey-eating birds in pollinating the various kinds of eucalypts now grown in New Zealand must at least be mentioned. It is a common sight to see tuis and bell-birds among the flowers in blue-gum plantations, even in well-settled districts where there is but little bush.

DISPERSAL OF TREE-SEEDS.

It has not been possible—in the case of forests in other parts of the world—to obtain figures showing the proportion borne by bird-disseminated plants to those in which the seeds or fruits are dispersed by the wind, but it may be safely said that in New Zealand the number of the former compared to the total is remarkably great. Working on a similar basis to that employed in calculating the proportion of bird-pollinated plants, the writers have found that about 65 per cent. of what may be fairly called forest-plants have more or less succulent fruit attractive to birds. Probably some tropical forests would show a similar proportion, but many mammals would be competing with the birds, and the part played by the latter in dissemination would be of less comparative importance.

Any one looking up a book of reference with a view to learning something of the timber-trees of the world could not help being impressed by the importance of the position occupied by the many different kinds of pines and firs in the Northern Hemisphere, and by the wonderful array of Australian hardwoods of the genus *Eucalyptus*. Every one of these trees owes its dissemination entirely to the wind. Now turn again to a consideration of the New Zealand forests and think of the timber-trees of which we are so justly proud. It is true that the most famous of all, the Kauri (*Agathis australis*) is disseminated by the wind; but there are many others hardly less valuable which have succulent fruits. Among these may be mentioned the totara (*Podocarpus totara*), matai (*P. spicatus*), white-pine (*P. dacrydioides*), and rimu (*Dacrydium cupressinum*). Other allied trees of less general importance but still of great value are Hall's totara (*Podocarpus Hallii*) and the miro (*P. ferrugineus*). Several trees closely allied to the rimu yield splendid timbers, though the majority of these are rare. The Westland or silver pine (*Dacrydium Colensoi*) must, however, be specially mentioned, as it is abundant on the West Coast, and as regards the quality of its timber is one of the most valuable trees in New Zealand. Every one of these taxads (as the trees of the yew family are called) is dependent on birds for the dispersal of its fruits.

It has been pointed out that the seeds of such trees would still reach the ground and be able to germinate there, even if the forests were quite birdless, simply by the falling of these fruits to the ground beneath the trees. This is quite true, and every bushman has seen the ground red with fallen fruit beneath such trees as rimu, particularly since the fruit-eating birds have become so much scarcer; but he knows also how rare a thing it is to find any young rimu-plants in such a situation. No attempt to explain this fact—which is noticeable in the case of many of the other taxads—is made here. It is only noted as a fact; but it is at once obvious that the regeneration of trees like these depends on more than the production of a large supply of fruit. The seeds must be distributed so that some at least will fall on ground where the conditions are favourable to the development of the young plant.

The difference between the potential value of a crop of seeds dropped beneath the parent tree and the same number carried far and wide over miles of country offering a variety of conditions suitable

to the development of the seedlings must be obvious to all. The young plants of many of the taxads already mentioned and those of a large number of other timber-trees find a suitable environment under the shade of those smaller trees and shrubs which form, as it were, the lower stories of the forest, fill up gaps between the larger trees, and fringe the edges where fire has been running. It is not proposed to give a list of these, but their number is very great, and the vast majority of them bear fruits attractive to birds. A few may be mentioned, however (besides those named on p. 302), such as the so-called matipo and the tarata (*Pittosporum* spp.), kaikomako (*Pennantia corymbosa*), ramarama (*Myrtus bullata*), pigeonwood (*Hedycarya arborea*), and many species of *Coprosma*, the larger-leaved kinds of which are generally called "karamu" by the settler. Of the timber-trees with fruits attractive to birds the taxads alone have so far been mentioned, but there are many others which should be included here if justice is to be done to the birds. Among them are the puriri, black-maire (*Olea Cunninghamii*), tawa (*Beilschmeidia tawa*), taraire (*B. taraire*), broadleaf (*Griselinia littoralis*), titoki (*Alectryon excelsum*), and the kohekohe (*Dysoxylum spectabile*)—the dearest timber in New Zealand at the present day.

Although the fruit-eating birds have been frequently mentioned, it has been in general terms only. The pigeon is undoubtedly the most important, on account not only of its voracious appetite and varied tastes, but also in virtue of its size, which enables it to swallow the largest fruits; and perhaps of all the forest birds, the pigeon is the most persecuted!

CHECKING OF INSECT PESTS.

There are in New Zealand thirty-six kinds of indigenous birds which are predominantly forest-dwellers. Of this total no fewer than twenty-eight subsist either wholly or in part on insects, sixteen live chiefly or partially on berries, and five suck nectar from the flowers of forest-trees and thus act as the chief agents of pollination. Two kinds of forest-birds only—namely, the bush-hawk and the quail-hawk (not to be confused with the harrier-hawk), which by several good authorities are considered only one species—appear at first sight to play no part whatever in the beneficial activities of the forest-birds. In fact, their own activities in destroying more useful birds might, from the human standpoint, be regarded as totally injurious were it not borne in mind that seeds from the crops of their victims find their way into the hawk's own stomach and are thus efficiently distributed.

In Canada the Dominion Entomologist has characterized birds as the most valuable insecticidal agency known. A little thought will convince any one familiar with the New Zealand bush and with its inhabitants that the scrutiny of every crevice of the bark, every twig, and every leaf by the birds is almost inconceivably minute. One of the writers was able to demonstrate this in a way which was so conclusive that, although the insect pest in question was not a forest one, a few details may be permitted here. A branch of rose-bush, almost literally covered with masses of green aphis or "green-fly," was placed in a tree remote from the house and watched. In a few minutes it had attracted the notice of a travelling party of white-eyes

(wax-eyes, or blightbirds); in less than half an hour the rose-branch, which was several feet long, was as clean of aphis as though it had been repeatedly dipped in a strong spray solution. Spraying is utterly impracticable in the case of forest insect pests, but there is in the birds an agency almost as efficient, perennially active, and costing nothing. Unfortunately, nearly every influence which European civilization brought into this country was deleterious to the indigenous birds—to these natural guardians of our forest wealth; and the birds have sadly decreased to such an extent that it becomes an essential part of forest policy in this Dominion to restore them to something like their former numbers. Certainly the native birds are protected by law, but something more than that is needed. People whose work takes them to the bush should learn what is owed to the birds, and a personal responsibility in the matter of bird-protection should be recognized by all.

It is a common occurrence to find in the bush a tree riddled by the "huhu" grub—the fleshy legless brown larva of a large beetle (*Prionoplus reticularis*). Such trees, whether dead or alive, have often considerable areas of softer material composed of sawdust and decayed wood supported by strong and resistant bands of still sound timber. For extracting the huhus from such a log a man would probably choose a stout knife for digging into the decayed and softer portions, while those larvæ which were deeply ensconced in crevices of the sounder timber would be conveniently extracted by means of a long pair of forceps. The huia—now, unfortunately for our forests, so rare that there is considerable ground for supposing it extinct—became so adapted to live upon wood-boring insects (and perhaps specially on the huhu) that it actually possesses the instruments suggested above as the most suitable for removing huhus from semi-decayed trees. The huia is unique in that the shape of the beak—a character so constant that it is used extensively in the classification of birds—is different in both sexes. The male's bill is moderately short and very stout, while that of the female is long, curved, and more pliable. When a pair of these birds is working on a tree-trunk, such as described above, the male chisels away the softer material and literally digs out the larvæ, while his mate inserts her long bill into the crevices and holes in the sounder wood, and deftly extracts the larvæ that are lurking there.

The forest, with the insects which prey upon its various constituent plants, may be divided into several horizontal layers. In each of the particular insect habitats thus delimited we have a special army of birds confining its insectivorous energies to that one habitat. Commencing at the forest-floor—that crowded lumber-room of leaf-mould, decaying logs, ferns, mosses, liverworts, fungi, and such seedlings as can grow in this stratum—the insects of this layer may be divided into permanent inhabitants which spend there their whole life-history from egg to adult, and insects of which only a portion of the life-cycle is passed on the ground, the portion spent there being usually either that of the egg or pupa (resting stage) or both, and less frequently that of the larva. The forest-floor is thus important from the economic viewpoint as a nursery for numerous insects which in their later stages will be destructive to the wood or leaves. The

policemen of this bottom layer are pre-eminently the kiwis and the wekas — both flightless birds which have suffered severely from "civilization." The sensitive nostrils at the top of the bill, together with the strong clawed feet, render the kiwi efficient in discovering among the debris grubs and insects of various kinds. The incessant curiosity of the weka, his persistent "howking" among rubbish and leaves, guided by his unrivalled eyesight, leaves no insect safe. In fact, as a high authority in the United States has written, "it is probable that no species of insect is so completely protected by its habits of life that it is not found and preyed upon, at one or another stage of life, by some species of bird." The activities of these larger birds are supplemented by the North Island and South Island robins, tame and familiar birds whose habit of feeding so largely on the forest-floor, thereby rendering them more liable to the attacks of ground-vermin, has probably been a potent factor in their widespread decrease. There are four other species which obtain the greater portion of their food from the ground. These are the North Island and South Island thrushes (now almost extinct) and the white-breasted and yellow-breasted tits, which, following a great decrease, are now in considerable numbers almost anywhere where forest remains, thus incidentally affording a proof that our native birds are not gone irrevocably. The green wren—a rare bird confined almost solely to the great beech forests—and the little rifleman, our smallest bird, frequently extend their arboreal researches to the ground at the base of the trunks. So much for the forest-floor.

The trunks of the trees and the larger branches, with their dense coating of mosses, ferns, and other perching-plants, and of creepers, form the chief hunting-ground for the rifleman, which wanders over every inch of the surface, probing with its awl-like slightly upturned bill into crannies and cracks and into the damp recesses of moss cushions. The green wren in its search for the insects which constitute its food employs a similar method. The same scene of operations is shared by the saddleback, huia, and kaka, all of which obtain their insect prey from decayed wood and among the bases of epiphytes and masses of creeper.

The absence of overlapping in the hunting-grounds of the great ecological groups into which we are here dividing the birds is rather remarkable. The rifleman, one of the most assiduous of the trunk-searchers, rarely by any chance wanders to the leaves and twigs, which are the beat of a third preventive corps including in its ranks the brown creeper, the whitehead, the yellowhead, and the grey warbler. The close scrutiny of slender swaying terminal twigs necessitates not only a patient assiduity but also an added agility, which shows itself in the beautiful acrobatic performances of the three former species, and in the fluttering movement of the grey warbler in its efforts to take insects from twigs too slender to bear even its tiny weight.

So the grey warbler, in thus taking prey on the wing and even occasionally chasing in the air moths which it has dislodged, affords an easy transition to the next group, which takes its food almost entirely in the air. Here come those expert fly-catchers, the pied and the black fantails, with their familiar habit of sitting alert on a twig, whence they dash after flying insects of various kinds, in the

pursuit of which marvellous aerial evolutions, assisted by the fan-like tail, are gracefully performed, and the clicking of the tiny bristle-fringed mandibles as they snap on the prey is often distinctly audible. Possibly belonging to this class are the kingfisher, the shining cuckoo, and the long-tailed cuckoo, all of which are in the habit of darting on their prey from a position of vantage. Our kingfisher, unlike the English species, lives only to a relatively small extent on fish, the majority of his food consisting of insects. The morepork, too, takes the whole bush as his hunting-ground and pounces on his prey—here again mostly insects from the air.

To sum up the activities of the insect-eating birds we have divided them according to their feeding-haunts into four main groups, comprising those which exploit the resources of the forest-floor, those which subject the trunks and boughs to a searching scrutiny, those which hunt in the twigs and leaves for their prey, and finally those birds which from a point of vantage take the whole of the surroundings into their purview and either chase their prey in the air or pounce upon it elsewhere.

CONCLUSION.

The whole subject of the relation of birds to the forest is so vast that the writers, in leaving it here, feel that they have given but a sketchy outline. It is hoped, however, that sufficient evidence has been brought forward to indicate at least that the influence of the forest-birds is predominantly good, and, indeed, that a bird in the bush is worth two in the hand!

REGISTRATION OF APIARIES.

In compliance with the regulations under the Apiaries Amendment Act, 1913, as to the registration of apiaries, every person keeping one or more hives of bees is required to make application to register same during the month of June, 1923. Applications will be received by the Director of the Horticulture Division, Department of Agriculture, Wellington. Registration is free of charge; the penalty for non-registration is a fine not exceeding £5.

Beekeepers are requested to note that this year provision has been made on the registration card for a declaration as to the quantity of honey and beeswax produced during the season ending 31st May, 1923. This information is being sought through the Department by the Government Statistician, under the Census and Statistics Act, 1910. In the circumstances beekeepers should appreciate the need of prompt and accurate returns being rendered as early as possible after 1st June.

Cards of application for registration are being forwarded to all beekeepers on the Department's register, but should any person requiring same not receive a card he should make immediate application for one. The cards will be obtainable from the principal district offices of the Department of Agriculture or from the Director of the Horticulture Division, Wellington, or from any of the larger post-offices throughout the Dominion.

Correction.—In the list of Jersey C.O.R. bulls printed on page 202 of last month's *Journal* Sultan's Disdain was credited with 12 C.O.R. daughters—3 qualifying during 1922. The figures should have been 14 and 5 respectively. Consequentially the aggregate of certificated daughters of Jersey C.O.R. bulls is raised from 768 to 770.

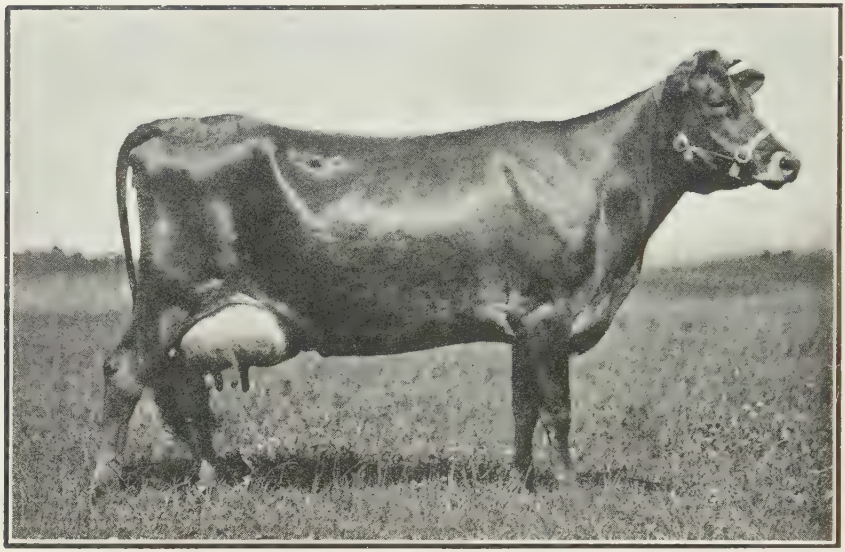
TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR MARCH AND APRIL.

Dairy Division.

THE following list comprises the records of cows which received certificates during March and April, 1923 :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Mercedes Lady Viola	H. C. Sampson, Hillsborough	2 78	248·3	365	9,670·3	524·63
Holly Oak's Jewel ..	John Hale, New Plymouth	2 49	245·4	361	7,680·3	494·44
Snow View Snowdrift	T. W. Perger, Waitara	1 248	240·5	314	6,408·0	424·68
Melissa of the Cliffs..	Mrs. A. E. T. Rhodes, Timaru	1 308	240·5	364	6,867·0	348·53
Bridge View's Molly	F. Hoskin, Matapu ..	2 19	242·4	279	5,965·5	319·99
Springbank Joy ..	E. S. Holdaway, Ballance	2 22	242·7	292	4,783·6	286·03
Top's Beauty ..	H. J. Burrell, Bunnythorpe	1 323	240·5	183	5,468·3	283·04
Hope of Bulls ..	F. J. Watson, Bull's	1 360	240·5	338	4,947·1	241·36
Senior Two-year-old.						
Holly Oak's Beauty	John Hale, New Plymouth	2 165	257·0	357	8,292·3	589·77
Dulciphone ..	A. J. Hale, Hillsborough	2 192	259·7	365	10,071·1	504·96
Three-year-old.						
Delilah	J. Nicholson, Manakau	3 126	289·6	365	10,916·3	641·19
Waipiko Joan ..	C. G. C. Dermer, Waipiko	3 311	308·1	365	10,159·3	535·42
Four-year-old.						
Petunia	F. Hoskin, Matapu ..	4 252	338·7	310	7,730·9	381·42
Mature.						
Luciana of Willow Bank	J. S. Jones, Bell Block	5 123	350·0	365	11,120·5	666·02
Miro Meadow's Queen	A. A. Ward, Tariki ..	7 66	350·0	365	9,860·6	608·92
Spec's Lassie ..	A. J. Harris, Bombay	5 219	350·0	321	10,402·8	580·66
Queen's Bess ..	F. Hoskin, Matapu ..	8 351	350·0	365	11,262·3	542·13
Waipiko Dawn ..	Oscar Monrad, Palmerston North	9 41	350·0	365	10,461·6	541·38
Fairview	F. L. Washbourn, Timaru	10 329	350·0	365	10,699·6	412·79
	FRIESIANS.					
Junior Two-year-old.						
Rosevale Catrina Posch	H. North and Sons, Omimi	2 8	241·3	365	19,641·5	592·18
Rosevale Burkeyje Catrina	H. North and Sons, Omimi	2 44	244·9	365	15,627·9	566·52
Rosevale Princessje	H. North and Sons, Omimi	2 30	243·5	364	13,116·8	471·24
Maidstone Karo ..	John Fisher, Cambridge	2 99	249·5	365	6,926·6	249·98
Ashlynn 94th ..	R. Marr, East Tamaki	1 203	240·5	283	6,929·9	246·69



LADY QUICKSTEP (MRS. M. A. GADSBY, STRATFORD).

C.O.R., Jersey mature class (10 years 30 days): 10,499·4 lb. milk, 701·30 lb butterfat, in 365 days.

MATANGI QUALITY 4TH (RANSTEAD BROS., MATANGI).

C.O.R., Milking Shorthorn two-year-old class: 14,572·8 lb. milk, 591·89 lb. butterfat, in 365 days.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
FRIESIANS—*continued.*						
Junior Three-year-old.						
Rosevale Sylvia Colantha	H. North and Sons, Omimi	3 126	289·6	365	20,273·1	716·62
Cordyline Peace ..	George Aitchison, Kaitangata	3 56	282·6	365	15,585·0	610·50
Dutch Cadilac Queen	W. I. Lovelock, Palmerston North	3 54	282·4	365	14,956·3	520·14
Guineaslea Queen ..	L. R. Stoddart, Willowby	3 6	277·6	365	14,910·3	511·21
Junior Four-year-old.						
Rosevale Beauty Posch	H. North and Sons, Omimi	4 61	319·6	365	23,942·1	806·03
Rosevale Queen Daphne	H. North and Sons, Omimi	4 173	330·8	365	20,050·3	805·54
Rosevale Nancy Posch	H. North and Sons, Omimi	4 110	324·5	365	21,652·2	716·35
Ellesmere Grace ..	D. Dickie, Wellington	4 62	319·7	365	17,371·9	625·34
Fairview Netherland Queen	Mrs. T. E. F. Hardwick, Kennington	4 63	319·8	365	16,237·1	545·01
Te Aroha Tulip ..	F. O. Stack, Kiwitea..	4 102	323·7	365	10,973·2	498·38
Lakeview Nazline Kroons	Bloomfield Farm Company, Wellington	4 79	321·4	365	15,390·4	455·32
Senior Four-year-old.						
Princess Van Friesland Park	A. S. Elworthy, Timaru	4 268	340·3	365	17,868·6	592·45
Mature.						
Belle of Friesland ..	C. H. Steadman, Kamo	9 40	350·0	365	21,519·4	822·67
Nazli Segis de Kol ..	G. A. Marchant and Sons, Cardiff	5 203	350·0	365	14,974·8	576·25
MILKING SHORTHORNS.						
Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Pine Farm Jewel 4th	J. Parkinson, Opotiki	2 136	254·1	365	12,163·9	472·34

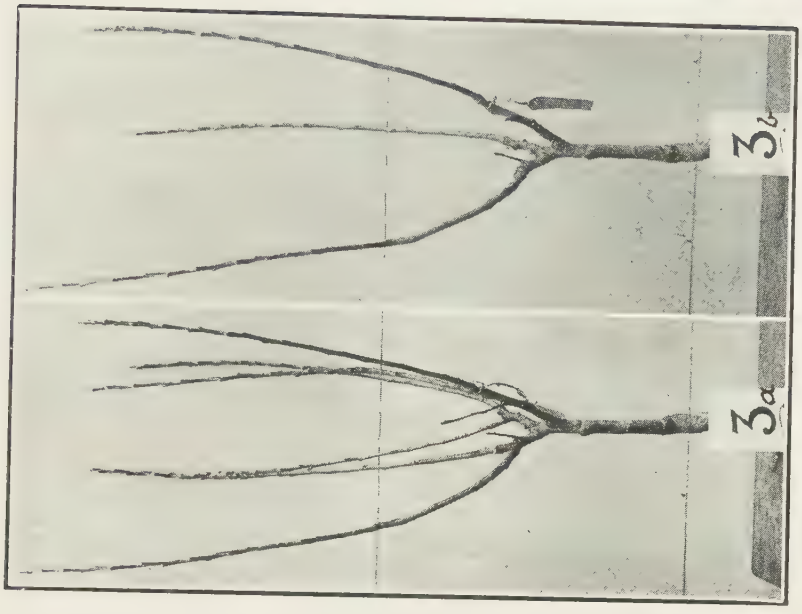
Second-class Certificates.

JERSEYS.						
Junior Two-year-old.						
Marmion of Rosy Creek	E. Joyce, Kaponga ..	2 60	246·5	365	10,893·3	500·53
Waimana's Golden Gipsy	A. Buchanan, Palmerston North	1 314	240·5	365	5,412·4	305·87
Tawa	A. W. Clow, Birkenhead	2 69	247·4	365	4,944·3	298·95
FRIESIANS.						
Junior Two-year-old.						
Longbeach Clematis	J. H. Grigg, Longbeach	2 0	240·5	365	15,841·0	700·42
Oaklea Princess Netherland	S. Knight and Sons, Ongarue	1 104	240·5	365	10,767·9	360·84
AYRSHIRE.						
Two-year-old.						
Glencairn Kate .	A. Montgomerie, Kauwhata	2 339	274·4	365	12,140·3	573·48

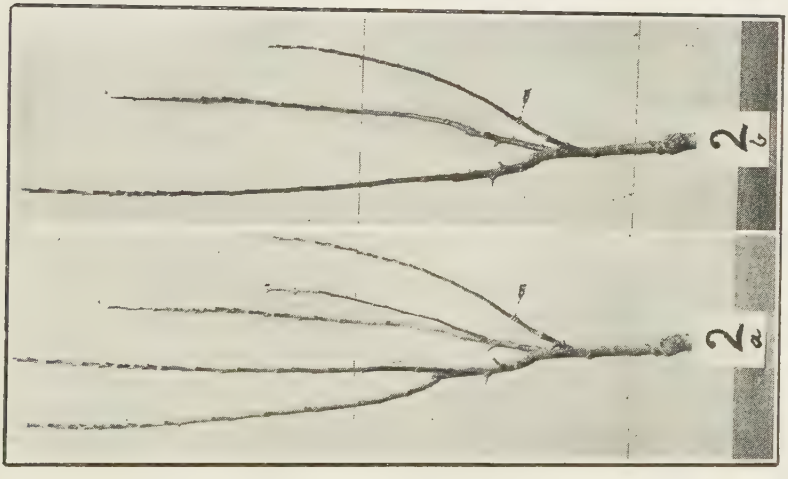
PRUNING YOUNG APPLE-TREES FOR BALANCE.

Horticulture Division.

THERE is some diversity of opinion as to the best pruning for a young apple-tree when one of the main arms is much weaker than the others. In order to test the matter an experiment was carried out at Arataki with three young Sturmer apple-trees. The results are demonstrated by the accompanying photographs. Each tree had three arms, two strong and one weak, the latter being identified in each case by a tag. In Fig. 1*a* the weak arm was so pruned as to leave it 5 in. higher than the other two, and the tree is seen as it appeared before the second winter pruning. Fig. 1*b* shows the same tree with surplus growths cut away. The arms left have not been shortened, so that the growth made by each arm may be clearly seen. These general remarks apply also to the other two trees. In Fig. 2*a* the weak shoot was cut hard back, only 2 in. of its length being left, and the strongest arm was left about 10 in. higher than the weak one. The photo shows the subsequent season's growth. Fig. 2*b* shows the same tree after removal of surplus shoots. In Fig. 3*a* the weak arm was left 6 in. long, and the strongest 2 in., the growth made being seen. Here, again, the same tree with surplus growths removed is shown in Fig. 3*b*. It will be seen that the two trees on which the weak arms were left longer than the strong arms are now well-balanced trees, and that the tree on which the weak arm was cut hard back is still badly balanced. The experiment was extremely interesting, and is recorded with a view to bringing the matter to the notice of those who wish to investigate the question further.



PRUNING YOUNG APPLE-TREES FOR BALANCE.
(See text on opposite page.)



SEASONAL NOTES.

THE FARM.

CULTURAL OPERATIONS.

ANY remaining stubble or other vacant land intended for crops next season should be turned over, care being taken, however, not to work heavy soils if too damp. If required, early-fed turnip breaks may be ploughed or disked at once, and sown either in oats or barley for spring feeding. A seeding of 3 bushels per acre, using 1½ cwt. of superphosphate, is suitable for average conditions.

In the grain-growing districts the last of the winter wheat should be sown not later than June. The importance and advantage of using pure seed require further stressing. Lincoln College is now supplying pure strains of Pearl and College Hunters at only 3d. above the price of ordinary seed-wheat. Growers may be recommended to obtain their supplies from the College in the first place, and then rogue sufficient of the crop each year to ensure a supply of good seed for their own use at least.

MANGOLD PULLING AND STORING.

Although mangolds may be left in the ground until July or August, they should for preference be pulled in June and allowed to ripen. As well known, freshly pulled mangolds are a dangerous food, especially for dairy cows, and they should always be pulled from four to eight weeks before feeding. The longer they are stored the better the feeding-quality.

When the roots are lifted they should be carted from the field and stacked in a dry situation convenient for feeding-out. In the colder districts subject to heavy frosts they should be covered with straw or fern and earth to prevent them from frosting. Where this is done the top of the clump should be left open for a time to allow the escape of any vapour that may collect from heating. In the warmer parts of the North Island mangolds will keep quite well stacked without covering, especially if placed under the shelter of trees such as pines. It is the first few days after pulling that the mangold is most subject to frost, and where there is a danger of this and the crop cannot be carted away at once the roots should be thrown into small heaps and covered by their leaves until the skin has toughened. Mangolds are sometimes stacked leaves and all, but this practice cannot be recommended. It is better to twist the tops off than to cut them off, as the root bleeds more or less when cut and does not keep so well.

Where mangolds are grown in larger areas and the labour of stacking is prohibitive they may be harrowed out by chain or tine harrows and allowed to lie in the field until required.

IRRIGATION FARMING.

In Central Otago the chief work apart from ploughing will be that of running contour ditches to those parts of the paddocks which could not be properly irrigated during the past season. As the subsoils of Central Otago do not differ very materially from the surface, deep ploughing should be resorted to. The reason why the surface soil does not differ much from the subsoil may be explained from the fact that the fine particles are not moved downward to any extent by percolating water. An arid subsoil as a rule does not possess the raw or unproductive nature that characterizes the subsoil of a district such as Southland, which must be weathered after deep ploughing and before the crop is sown. In Central Otago therefore, with very few exceptions, deep ploughing may be done without detriment immediately prior to the sowing of the crop; in fact, such practice is of great benefit, because it allows deeper root-penetration and greater retention of moisture. In the process of levelling portions of the land on Galloway Irrigation Experimental Area the soil was sometimes removed to a depth of several feet without injurious effect on the crop which followed.

In certain parts of Central Otago only a light layer of mica-schist soil exists, the subsoil being more or less pure gravel. It would, of course, be folly to plough this type of land deeply or to use it for cropping purposes. The best method of dealing with this type is to skim-plough and get it sown down in some such permanent crop as lucerne or grass. The ploughing-in of green crops of clover and the like will also be of assistance in giving body and depth to light soils, and every irrigator should endeavour to build up the poorer types of soil in this manner.

FEEDING OF ROOTS.

When roots are being fed out to stock an ample supply of hay or chaff should also be provided. As far as possible feeding-out should be done on fields where the pasture is becoming weak or where the grass-grub has been troublesome. By this means seed from the hay is tramped in, while the consolidation improves the pasture and helps materially in ridding the ground of the grub. If oaten hay or hay containing very little seed is being fed out it is a good plan to scatter some clover or grass-seed over the land being fed on, but this should not be done until August or later.

Carrots may be left in the ground until required. Unlike mangolds, they can be fed straight from the field at any time.

In feeding off turnips with sheep, breaks of an area to last the mob about twelve days should be aimed at. Where a good deal of rot is showing in swedes the crop should be fed off as quickly as possible, so as to make the best of it.

CARE OF THE EWE FLOCK.

During the period of gestation, when the ewes require extra food, a field of turnips is of great value. When frost is on the turnips, however, the sheep should not be turned on to the crop until the frost has thawed. They can be left there during the day, but should be taken off before sunset and returned to a grass-paddock where hay in racks is also available. The hay helps to take the chill off the turnips, and the grass acts as a laxative.

The daily shifting to the turnip-paddock and back is very beneficial to the ewes; it helps to keep them in good order generally, and the exercise assists greatly in preventing eversion of the vagina. This trouble, which is liable to occur a few days prior to lambing, is most marked in seasons when feed is too plentiful and the ewes do not have to move far for it, taking little exercise and lying down a great deal. Another advantage in shifting the sheep daily is that they become accustomed to one's presence and easier to handle, which may be very useful at lambing-time.

GENERAL.

More time will now be available for odd jobs. One of the first should be the draining of any boggy places likely to trap weak stock in the spring. Creek-crossings should also be seen to. Hedge-trimming may be undertaken. The repairing of fences and equipment, and the hundred-and-one things always calling for attention on the average farm, will fill in all available time.

Tree-planting for shelter purposes and general improvement of the country-side is important work which can be commenced in June.

POULTRY-KEEPING.

CARE OF THE PULLETS.

JUNE is almost always one of the coldest months of the year. It is therefore imperative that the pullets be given the best possible attention to enable them to produce. The diet at the present time should be carefully studied. In the first place the food should be of the right quality—food capable, after the bodily wants of the bird have been supplied, of going to the manufacture of eggs. It is impossible to get something from nothing, and the scientist has yet failed to discover just how much a hen needs to nourish her body or to manufacture her almost daily egg-product. The only safe course where the high-typed layer is concerned is to give her as much as she can eat without waste. While the food should be ample it should be also of a nourishing nature, in order that the bird be maintained in vigorous health and enabled to stand the great drain on her system which heavy egg-production entails.

Of late I have frequently been called upon to advise poultrymen in regard to the failure of their pullets commencing to lay when expected. On reaching the scene of the trouble I have always found either that the starvation process has been at work, or that the food supplied did not contain sufficient nutriment even to maintain the birds in proper health, much less to enable them to produce eggs. It must be admitted that pullets generally are slow in commencing to lay this season. This is no doubt chiefly due to the unfavourable weather conditions experienced; but it will not help matters by reducing or placing the birds on an inferior ration. An example of the benefit of giving the laying-birds an ample and nourishing ration is frequently provided in the case of hens mothering chickens. These hens will come on to lay even before the chickens are ready to leave them, and probably lay better than any member of the flock. The reason is not far to seek. They have been frequently and liberally fed owing to the attention given to the chickens with them, and thus, having assimilated something more than is required for bodily maintenance, their egg-producing functions have been stimulated and laying naturally ensues.

Giving laying-fowls all they will eat does not mean giving them a liberal ration at one meal and a spare ration at another; it means liberal and regular feeding. Plenty of sound grain food, green material, and meat food are necessary for the production of winter eggs, while sharp gravel-grit, crushed oyster-shell, and clean water should be always available to the birds. Where boiled meat is not available meat-meal should be judiciously supplied in the morning mash, but it should also be available for the birds to pick at it in a separate receptacle. Above all, the general plan of feeding should not be changed—the more uniform the feeding of the bird the better. Change of food and environment are two common causes of pullets going into a false moult, which means at times heavy losses to the poultry-keeper.

It should always be remembered that winter eggs are an artificial, out-of-season product. Obviously the more congenial the surroundings the better chance the bird has of laying to the best advantage. Thus comfortable, clean houses that are free from vermin, and the provision of good dusting-places, are just as necessary as proper feeding.

THE BREEDING-HENS.

When dealing with the hens that are to be used for next season's breeding operations every care should be taken to bring them to a proper condition at the time of mating. Upon the treatment a hen receives now will largely depend her success as a breeder. It is obvious that unless she is in perfect "nick"—her constitution unimpaired and her blood in perfect order—she will not be able to lay eggs containing the desired strength of germ to produce healthy, vigorous progeny. The breeding-hens should be well fed, but they should be handled in such a way that they will not get too fat. Where possible it is advisable to give them their liberty so that they may secure plenty of natural food, and in addition take natural exercise. Confinement, indeed, is bad for all classes of poultry, except, of course, birds being prepared for the table. This treatment should not be confused with the management of the heavy layer in the cold months of the year, when to obtain the best results the layers should be confined in a spacious open-front house on cold, wet, and windy days.

While it is true that the high-type layer cannot be overfed on a proper egg-producing food, it is possible to make a bird overfat when she is on a diet such as that desirable for the intended breeder, in which there is only a small amount of forcing ingredient. From now onward and right through the breeding season it will generally be found that better fertility and stronger stock is obtained by feeding a variety of grains to the breeders night and morning—no mash food whatever to be supplied. Of course, the grain should be fed in a manner that will induce a maximum amount of exercise, such as by throwing it in a deep litter and making the birds scratch for it. Another means of maintaining the breeding-bird in good condition is to keep it well supplied with green material.

It is safe to say that half the troubles met with in the hatching and rearing of stock could be traced to improper management of the parent stock. Probably the chief weakness would be found in allowing the female stock to get into an overfat condition either before or when mated. For any purpose for which fowls are kept I believe in feeding them well, but in the case of birds intended for breeding it may be necessary at times to depart from this rule. Where the birds

are putting on much surplus fat it will probably be found a wise course to slightly reduce the ration, in order that they may be maintained in a more or less lean, active condition—a state which is essential for best results. On the other hand, as before mentioned, in feeding a laying flock it is always better to give a little too much than too little food.

—F. C. Brown, Chief Poultry Instructor.

THE ORCHARD.

CONFERENCE-TIME.

THE Provincial and Dominion conferences will now be occupying a good deal of the fruitgrower's time. While performances may fall short of ideals, most thoughtful growers appreciate the progress made as a result of these gatherings. They form a proper and constitutional opportunity for the ventilation of grievances and difficulties, and quite an imposing list of benefits to the industry can be listed as a result, while the educational and social advantages are by no means unimportant. A much larger measure of success will be attained if each grower gives the remits careful consideration and afterwards attends these meetings. There will be a richer harvest of well-thought-out opinions and suggestions that will include the welfare of the trade in general with that of the individual.

PRUNING.

It will soon be time to think of orchard pruning—the most important operation of the winter months. The pruning of fruit-trees, bushes, and plants is a big subject. It may be useful here to draw attention to some of the common mistakes and more recent improvements.

Dealing with stone-fruit first, a vast improvement in the growing of peach and nectarine trees is very noticeable generally. The bare forks and branches that used to be so conspicuous in these trees are now hidden by useful foliage and fruitful laterals, and the best types bear all over from the ground to the tops. This has been brought about chiefly by keeping the framework of the tree open and admitting the sunlight, at the same time giving careful attention to the fruiting-laterals by keeping them well spaced and paying attention to renewals. The old method of cutting leading growth back severely to force out laterals has been replaced by moderate pruning-back of the leader and maintaining good lateral growth by cutting back weak and old laterals to base buds, thus renewing them. This treatment gives a tree with open tops and well-furnished base, entirely different to the crowded tops and bare base of the old type.

A somewhat similar change has been made in the pruning of apricots. This vigorous subject was found difficult to keep within bounds, and by many the crude method of cutting it down to the desired height was adopted. The result, during the following summer, was a heavy crop of young wood that badly shaded the base of the tree and quickly threw it out of profit by destroying the laterals. Such illogical methods are quickly becoming superseded now. The hard pruning necessary in the early stages of the growth of the tree is gradually relaxed as maturity approaches, and the tree comes into bearing earlier—the most effective break of all on vigorous growth. This too gives the desirable open tops, while the fruiting-laterals furnishing the framework of the trees are kept strong and fruitful by careful thinning and shortening them to wood-buds. Wonderful changes can be gradually brought about by adopting these newer methods with stone-fruit trees.

Owing to the susceptibility of this class of trees to bad attacks of many kinds of fungus it is necessary without delay to carefully dress all large wounds with tar.

The problem of handling the prunings in a large orchard is sometimes very considerable. A good method of disposing of them is by means of a fire-cart—an iron tank with perforated bottom, mounted on three low wheels and with a pair of long shafts. This is driven through the orchard after pruning is completed, and the prunings burnt as gathered and dropped again as ashes.

GENERAL.

Continue the preparation of land for planting. Should trees arrive from the nurseryman at an unsuitable time for immediate planting, heel them in carefully in the ground without delay. Too often poor results are due to the roots being allowed to dry out.

Keep in close touch with developments in the fruit store, and continue to ventilate freely.

—W. C. Hyde, Orchard Instructor, Nelson.

CITRUS FRUITS.

Apart from the usual monthly procedure of picking off such fruits as have reached maturity, there is little to be done at this season of the year in the citrus-orchards. However, where young trees up to three and four years planted are in situations subject to damage from frosts, it is advisable to afford as much protection as possible by means of scrim or sacking covering placed over the trees as soon as the frosty weather makes its appearance.

—J. W. Collard, Orchard Instructor, Auckland.

THE APIARY.

WINTERING OF BEES.

THE New Zealand climate being comparatively mild, the successful wintering of bees in any part of the Dominion does not present any great difficulties. As, however, the mildness of the climate tends to make the average beekeeper careless in this regard, reiteration of some of the essentials to successful wintering seems desirable.

Some districts are favoured with winter flowering nectar and pollen-yielding shrubs. Losing sight of the fact that weather conditions during the winter seldom permit of the bees availing themselves of these sources of supply, many beekeepers trust in a measure to the bees securing some nectar from them, and leave the colonies correspondingly light in stores. The result of this policy is the stoppage of brood-rearing at the most critical time. It is very essential that the bees should go into winter quarters with the largest possible number of young bees. To ensure this brood-rearing must be kept up as long as possible; and to secure this ample stores are necessary.

Young queens are another essential. Old queens will ease off in their egg-laying much earlier than young queens, especially if the old queen has been laying heavily and continuously right through the spring and summer.

Every effort should be made to preserve the warmth of the cluster. A good sound hive must be provided, free from large cracks or joints. The entrance should be reduced to 3 in. or 4 in. in width and not more than $\frac{5}{16}$ in. in depth. If the colony is very weak the entrance should be reduced even more. Bees do not require any ventilation during the winter months other than provided by the entrance. If the entrance is more than $\frac{5}{16}$ in. deep mice will enter when the bees are dormant, and damage the comb and eat the honey.

Needless to say, a good roof is essential, but as it is the most difficult to make it often receives the least consideration. The flat telescopic roof is generally considered to be the best. In making this type of roof the outside framework is first required. This should be made of 1 in. timber, double-dressed, and preferably totara or some equally durable timber. The inside dimensions of the frame should be $\frac{1}{2}$ in. longer and $\frac{1}{2}$ in. wider than the outside measurements of the hive-body, and $1\frac{1}{2}$ in. deep. While the roof is less likely to blow off if telescoping 2 in. or 3 in., it is found that the wider framework is liable to warp with the sun. The frame when nailed together at the corners should be squared and then covered with $\frac{1}{2}$ in. timber—the sides of benzine-cases answer the purpose. The parts of the frame that will be exposed to the weather should now receive three coats of paint. The best covering is No. 28 gauge galvanized iron. This should be cut 3 in. longer and 3 in. wider than the outside dimensions of the frame, to allow of its being bent over $1\frac{1}{2}$ in. approximately, on either side and end.

To accomplish this place the iron on the floor and the roof in position in the centre; hold the roof in position by standing or kneeling upon it, and beat the iron into position with a hammer or mallet, securing it with $\frac{5}{8}$ in. clout nails along the side. A cheaper roof may be constructed by substituting ruberoid for the galvanized iron, but the difference in cost is negligible; the iron-covered roof will last much longer and be cheaper in the end.

Quietude is another essential to successful wintering. In districts where the bees do not fly freely during the winter or the cluster does not thaw readily under the influence of a few puffs of smoke the bees should not be disturbed. Bees naturally gorge themselves with honey when disturbed. This is followed by a corresponding necessity to void the excreta, which the bee accomplishes while flying. If weather conditions make it necessary for them to retain this impurity for a number of days it tends to undermine their constitution and induce dysentery.

Given a sound hive (bottom-board and roof) and ample stores, the next concern is to see that the bees occupy a sunny position sheltered as much as possible from the prevailing wind, and high enough from the ground to escape the dampness arising therefrom. If these matters have received full consideration the bees should not require any further attention until the spring.

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

CABBAGES for the earliest spring supply are in many cases already planted; where they are not the plants should be got in wi hout delay. The true earlies make very small heads and require very little space. The rows need not be more than 18 in. apart, with the plants 12 in. apart in the rows. Well-drained land is especially necessary for the early crop; if the soil holds water it will be cold and progress of the plants delayed. Farmyard, stable, or animal manure of any kind should not be used for early crops; it holds water like a sponge and makes the ground cold. A dressing of 2 oz. or 3 oz. of blood-and-bone per square yard may be given, or the same amount of superphosphate with $\frac{3}{4}$ oz. of sulphate of ammonia added. When the plants begin to grow, a dressing of nitrate of soda, $\frac{1}{2}$ oz. to $\frac{3}{4}$ oz. per square yard, will hurry them along.

Beds of young turnips should have what attention they require in the way of thinning as early as possible. White-fleshed varieties do not require much thinning. They begin to bulb early, and if they are pulled as soon as ready room is made for others. The yellow-fleshed varieties stand longest; these should be thinned at once to allow space for the development of each root.

A good many people have the idea that summer variety of rhubarb should be lifted in winter and be kept out of the ground till spring. This is quite wrong; it should not be disturbed except for special reasons, but if it is lifted it should not be replanted till spring. This is practiced not because it benefits the rhubarb, but because if it were planted back during winter the soil would become weedy. As the plants remain dormant till spring it is best to delay planting till that time, when the roots can be planted in freshly worked, clean soil.

SMALL-FRUITS.

Strawberries.

Well-drained soil is essential for strawberries, for although the roots do not penetrate far down they are as fine as hairs and perish during winter in soil that holds surplus moisture. Planting practice differs according to climate, and to some extent according to the extent of the planting. In places where a dry spring is usual planting is done in autumn, being usually completed before the end of April, so that the plants may get a hold of the ground before winter. Where a fair amount of rain is usual in spring, planting is best delayed till that time. During winter in normal places the soil grows weeds. The deletion of these from newly planted beds is a formidable task, as much of it must be done

by hand, and in many cases it is an impossible task. In such circumstances it is much better to delay planting till spring, the ground in the meantime being worked as opportunity offers, and surface cultivated immediately before planting. The runners should be secured in autumn and planted in nurse-beds, spacing them 3 in. or 4 in. apart in rows just wide enough apart to allow a flat hoe to pass between them.

The question of variety can be decided only by experiment, as a variety that does well in one place may not be worth growing in another. In the North Early Marguerite, a large berry of poor flavour, is almost the sole variety grown. In the South Laxton's Noble and Melba are the chief varieties cultivated. In middle districts all these varieties are grown, but Trollope's Victoria, now known as "Duke of Edinburgh," an old variety of excellent flavour, is giving most satisfaction.

Where established beds that are to be left for another season are affected with the leaf-spot disease, all the old leaves should be cut off and burned, and the plants sprayed with 4–4–40 bordeaux.

Loganberries.

Commercial plantings of this fruit are increasing, and in the course of the next few years it is likely to reach important dimensions. Planting is best done in spring; remarks on that head can therefore be held over. In commercial plantations, also in some gardens, the rods are tied to wire supports. In that case the bearing-rods are renewed each year. The usual practice is to leave pruning till winter. It is much better to cut the old rods out as soon as the crop is past, the young rods thus getting the benefit of a greater amount of light and air.

Raspberries.

Where extensions of plantations are intended strong young suckers that come up clear of the old stools make the most thrifty plants. A sufficient number of these should be lifted and heeled in for planting later on. When they are planted they should be cut down to about 4 in.

Raspberries are subject to two fungus diseases and a very damaging insect pest—the bud-moth, as well as to leaf-roller caterpillars, which are a minor pest. The cane-wilt disease was the subject of an article by Mr. G. H. Cunningham in the *Journal* for January, 1922. The disease is not at present of frequent occurrence except in one or two districts. The only control measure at present known is to cut out affected parts or the entire plant.

The other fungus disease is raspberry anthracnose, which is attacking plantations in a number of places in both Islands. This disease can be controlled, very satisfactory results having been secured by following instructions given by the Department. One of the necessary measures is to remove the old canes as soon as the crop is past, and to at once spray the new canes with 4–4–40 bordeaux. There is some superficial resemblance between the two diseases; therefore any one having infected plantations is advised to send specimens for identification of the disease. Cases of infection of loganberries by both these diseases have occurred, and the foregoing remarks apply equally to that plant.

The control of bud-moth rests largely on the destruction of the over-wintering grubs. These take shelter in trash about the stools, to some extent in the soil, and also in the hollow stubs of old canes. It is therefore important that the canes should be cut as low as possible, and some soil thrown into the stools to cover the stubs.

—*W. H. Taylor, Horticulturist.*

Cow with Triplets.—A cow belonging to Mrs. E. J. Innes, of Paroa, Greymouth, recently gave birth to three calves—one heifer and two bulls. The heifer was born without a tail, but the calves are all healthy and doing well, as also the mother. Triplets are very unusual among bovines, and it will be of interest to note whether in this case the heifer will breed. In about 80 per cent. of cases of twinning, when the calves are of different sexes, the heifer is a "free-martin"—*i.e.*, sterile.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COWS WITH CONTAGIOUS MAMMITIS.

"COCKY," Tutekehua :—

During this autumn some half-dozen of my cows have had an affection in one quarter of the udder. The first symptom is yellow curdy matter on the milk; then the quarter gradually dries until, after a few days, a quantity of curd comes, in some cases in lumps and in others ropy; finally a little watery matter only is given. The quarter is not hard, but feels just the same as the others. What is the cause and the remedy?

The Live-stock Division :—

Judging by the described symptoms your cows are in all probability affected with contagious mammitis. The cause of this disease is microbial, and it is spread from cow to cow by the milker's hands or the cups of the milking-machine. When such a condition as you describe is noticed in a cow's quarter no time should be lost in forwarding a sample of the secretion to the Officer in Charge, Veterinary Laboratory, Wallaceville, Wellington, who will examine the sample, and send you a report, free of charge. An ounce bottle is quite large enough. This is first sterilized by boiling (also the cork). The secretion is milked straight from the teat into the bottle, which is corked, labelled with number or name of cow, and forwarded, securely packed, to Laboratory. At the same time a letter should be forwarded explaining the nature of the cases. Treatment of contagious mammitis is unsatisfactory, and strict precautions are necessary to prevent its spread. The person milking affected cows must not handle a sound udder without first thoroughly disinfecting the hands (it is preferable to strip diseased cows last). The secretion must not be allowed to fall on the ground, but should be stripped into a kerosene-tin containing sheep-dip or some other strong disinfectant. The best procedure is to dry off and fatten cows affected with contagious mammitis, as it is possible for cows to remain centres of infection, giving rise to fresh cases the following season.

CONTROL OF MEALY BUG.

F. C. P., Gisborne :—

Would you kindly inform me if there is any effective method of getting rid of the mealy bug. It attacked my passion-fruit vines, which were growing on a trellis near the house. Acting on advice from experienced orchardists I cut the passion-fruit down. Unfortunately, the mealy bug has attacked the tomatoes, a white broom, and a chorizema.

The Horticulture Division :—

The control of mealy bug is an exceedingly difficult problem, as it attacks such a great number of different plants and shrubs. This is more particularly the case in the warmer districts, where the climate favours rapid and continuous propagation of the insect. In many cases hedges and shrubs of dense habit are attacked, and with these effectual spraying is a practical impossibility. Where such shrubs are infested they form breeding-grounds that are favourable to the insects, and other subjects are sure to be infested from these sources. Effective control is not likely under such circumstances until a natural enemy has been found, which has not yet been done. Cutting back the passion-vine was the only thing to do; it could not be sprayed. The spray that has shown the best results is red spraying-oil, 1 in 40, for evergreen trees or shrubs. This spray will kill young bugs, but will not affect eggs, therefore several sprayings are

necessary to effect a clearance. This treatment should be effective on the chorizema, which has fairly tough leaves. The broom would stand heavy cutting-back, which would simplify spraying. Apple-trees can be heavily sprayed with red oil, 1 in 8 or 1 in 10, when in a dormant state. Any shrubs that are found to be badly infested should be headed down, the prunings burned, and the headed shrub thoroughly sprayed.

PERENNIAL CANARY-GRASS.

"SUBSCRIBER," Pleasant Point :—

I would like to know if perennial canary-grass could be successfully grown on ridgy land which holds cocksfoot and other permanent grasses fairly well. When established would it be hard to eradicate like twitch, and what would its fattening properties be ? We have fairly hard frosts.

The Agricultural Instruction Service :—

Perennial canary-grass (*Phalaris bulbosa*) is a succulent and palatable grass which grows well during the winter and spring months and stands stocking well. It is not superior to prairie-grass, but it withstands frost very well and gives early spring feed. It is not a twitch, and would not be hard to eradicate. It is a deep fibrous-rooting plant, in most cases vested with a woolly covering, and requires a deep loose soil to give the best return. During the hot summer it makes no growth, and at such a period requires resting. It has been tried in Canterbury at various times but has not become generally popular. About 8 lb. of seed is required to sow 1 acre. The best time to sow would be early autumn, but sowings may be made in early spring.

SCABBY NOSES AMONG LAMBS.

P. BATES, Sen., Alford Forest :—

Will you kindly inform me as to the nature and cure of scabby noses among lambs ?

The Live-stock Division :—

Rough, rank grass, especially of autumn growth, often causes the condition your describe ; lambs depastured on stiff straw stubble also occasionally suffer in this way. The skin becomes broken and outside germs gain entrance, setting up a condition of gangrene which ultimately becomes covered with a dry, hard scab. The treatment recommended is to remove the lambs to a short, sweet pasture, and to dress those affected with a 5-per-cent. solution of one of the standard disinfectants, or with sulphur ointment (1 part of flowers of sulphur to 8 parts of vaseline or lard).

PROTRUSION OF THE OVIDUCT IN FOWLS.

H. SMITH, Kilbirnie :—

Can you tell me the cause of fowls picking each other's vent ? I lost a good pullet through this cause. I noticed that she was being pecked and removed her to another pen, but she was bleeding, and when she tried to get rid of her droppings other parts of her inside came out, causing her to die next day.

The Chief Poultry Instructor :—

The cause of the other members of the flock picking at the vent of this bird was no doubt due in the first place to a hæmorrhage, or to protrusion of the oviduct, or to what might be termed an ovarian disorder. This trouble is generally the result of overfeeding rich foods such as meat, milk, &c., while sometimes it is due to an overfat condition ; this applies particularly where a bird has a weak constitution. Of course, even in the best-managed of flocks an odd case of this kind is apt to occur, but if frequent cases appear the only safe course is to provide a less forcing ration. There is practically no cure for the trouble, and the only safe way of dealing with it is to prevent it.

PITTING POTATOES.

S. F. STEVENS, Takapau :—

Would you kindly inform me as to the proper way to pit potatoes. Is it necessary to place straw in the bottom of the pit for the potatoes to rest on ?

The Agricultural Instruction Service :—

To pit potatoes mark out the ground—space to be used—this should be from 4 ft. to 6 ft. wide—and build the potatoes up as high as they will comfortably sit. Then cover with from 6 in. to 9 in. of straw, and place a few inches of earth over this. If the weather is fine it is best to leave the top of the pit open for a few days to allow any steam to escape that may collect. It is not necessary to place straw below the potatoes. For North Island conditions potatoes are best kept in a dark shed where they can be easily got at should blight develop.

NASAL CATARRH IN SHEEP.

J. M., Auckland :—

A line of sheep I purchased at saleyards suffers from sore eyes, and a thick discharge from the nostrils which nearly blocks the nose and prevents breathing. I would like to know the cause, if the trouble is contagious, and if treatment is necessary.

The Live-stock Division :—

Nasal catarrh in sheep is most commonly caused by the presence in the nasal passages of the animal of the so-called nasal bot of sheep. This is the larvæ form of the sheep nasal fly (*Oestrus ovis*). The fly, in striking the sheep's nose, deposits the eggs, and the developing larvæ eventually reach the nasal cavities and air-spaces of the head. The irritation set up causes a thick discharge from the nostrils. The grub is often seen on post-mortem, when the sheep's head is cut in two. Treatment is not satisfactory. When mature the grub becomes dislodged from the nose.

RAISING PHORMIUM-PLANTS.

"SUBSCRIBER," Khandallah :—

I have saved a considerable quantity of flax (phormium) seed, and wish to raise plants for a breakwind. Should I sow *in situ* or sow in a seed-bed and plant out; when should I sow; and what other points should be observed ?

The Horticulture Division :—

The seeds should be sown in boxes or in beds; it is not practicable to sow *in situ*. Sowing in boxes is an advantage late in the season, as they can be protected from heavy rain. In the ground the seeds may be sown as though they were parsnip-seeds. As soon as the young plants can be handled they should be transplanted into lines in the open ground, spacing them about 6 in. apart in rows wide enough to hoe between. The plants will be ready for final planting in the spring of the following year. If the seeds are sown soon after being collected the young plants will appear inside of three weeks; if kept till spring they will be twice as long.

Winter Farm Schools.—A course for farmers, organized by the Westland branch of the Canterbury Progress League, will be held at Hokitika from 25th to 29th June. The lecturers will include several officers of the Department of Agriculture. In regard to the Ruakura Farm School, announced, together with others, in last month's *Journal*, applications for enrolment should be made to the Instructor in Agriculture, Department of Agriculture, Auckland—not to the Farm Manager as previously stated.

NEW ZEALAND INSTITUTE OF HORTICULTURE.*

CONSTITUTION AND RULES.

1. The name of the Institute shall be "The New Zealand Institute of Horticulture (Incorporated)."

The registered office of the Institute shall be in the City of Wellington, or in such other place in the Dominion as the executive of the Institute shall from time to time decide upon.

OBJECTS.

2. The objects of the Institute shall be—

(*a.*) To encourage, foster, and improve every branch of horticulture, ornamental as well as useful.

(*b.*) To exercise all the powers and functions of a horticultural nomenclature and certificating Board, including the making of decisions and reports in regard to the nomenclature of trees and plants, and to issue, in the name of the Institute, certificates, medals, or diplomas for novelties of merit or new varieties.

(*c.*) To assist and promote horticultural education in all branches and in every way possible.

(*d.*) To promote legislation having for its objects the advancement or protection of horticulture in any or all of its branches.

(*e.*) To assist research work in connection with any or all branches of horticulture.

(*f.*) To endow, assist, or support any chair or lectureship in any college, university, or other educational institution the Institute may decide upon.

(*g.*) To promote the interchange of horticultural knowledge and to co-operate with Governments, scientific or other societies or bodies, or persons in any part of the world who may be working along any or all of the lines covered by the objects of this Institute.

(*h.*) To undertake or assist in the introduction and acclimatization of any fruit-tree, flowering tree or plant, forest-tree, seeds, or other form of plant-life which in the opinion of the Institute should be introduced.

(*i.*) To establish, assist, or endow libraries, and to obtain by purchase, exchange, or otherwise books, papers, and other publications relating to any or all the matters covered by the objects of the Institute.

(*j.*) To arrange for the carrying-out of work of "bud-selection," the testing of new varieties of trees, plants, vegetables, and any and all things necessary to a better understanding of tree and plant life and the maintenance or improvement of the standard of such, whether originally raised from seed or from vegetable mutation.

(*k.*) To arrange for the selection and breeding of any or all classes of trees and plants for testing, and for the supply of certificated propagating-materials to nurserymen and others on such terms as may be arranged.

MEMBERSHIP.

3. (*a.*) Any person, society, association, firm, company, or other body accepting the objects of the Institute may become a member by subscribing to the funds of the Institute and accepting and complying with the rules thereof.

(*b.*) Honorary members: Persons who have rendered special services to the Institute or who for other reasons are deemed worthy of special recognition may be made honorary members.

(*c.*) Life members: Any person or firm accepting the objects of the Institute and donating in one sum ten pounds ten shillings (£10 10s.) shall upon election by the executive become a life member with all the rights and privileges of a full member of the Institute.

(*d.*) The secretary shall keep a complete and up-to-date roll of members.

4. (*a.*) Any member shall be entitled to withdraw on giving notice of his intention to do so, provided that all moneys payable to the Institute have been fully paid.

* The Institute is being registered under the Incorporated Societies Act, 1908.

(*b.*) Any member failing to pay his annual subscription within twelve months of the due date may be given one month's notice to pay the same, in default of payment of which his membership will be cancelled, and if after the expiry of such notice such annual subscription shall still remain unpaid, then such member's name shall be taken off the roll of members.

ALTERATION TO RULES.

5. The constitution, rules, and definitions of the Institute shall not, unless otherwise stipulated therein, be added to or altered except at the annual meeting of the Dominion Council or at a special meeting called for the purpose. Notice of any proposed alteration or addition to the rules must be forwarded by the secretary of the Dominion Council to each councillor and secretary to the District Councils at least fourteen days before the date of the meeting at which such proposed alteration or addition is considered.

THE DOMINION COUNCIL.

6. (1.) The affairs of the Institute shall be managed by a council termed the Dominion Council, representing the District Councils, and by an Executive Committee, and these bodies shall have power to elect such sub-committees as may be deemed necessary from time to time to assist them in carrying out their duties.

(2.) (*a.*) For the purpose of giving representation to the whole Dominion the country shall from time to time be divided into districts by the executive; each district shall have a District Council consisting of all members of the Institute within the district, and each council shall set up a district executive.

(*b.*) The Dominion Council shall consist of delegates appointed by the District Councils. Each District Council may appoint one delegate for every hundred members or fraction thereof. The following persons shall also be members of the Dominion Council: (1) Director or Assistant Director of the Horticulture Division of the Department of Agriculture; (2) the accredited representative of the New Zealand Fruitgrowers' Federation (Limited); (3) the accredited representative of the New Zealand Association of Nurserymen (Incorporated); (4) the accredited representative of the New Zealand Farmers' Union; (5) the accredited representative of the horticultural societies that are members of the Institute (until such time as the horticultural societies of the Dominion are controlled by a central governing body the method of electing a representative for such societies must be approved by the executive); (6) the accredited representative of the New Zealand Forestry League; (7) a secretary and treasurer or secretary-treasurer.

Notice of the appointment of a delegate, signed by the secretary of the District Council, must be in the hands of the secretary to the Dominion Council at the date of the annual meeting of the council.

OFFICERS.

7. (*a.*) The officers of the Institute shall be patrons (who shall have no voice in the affairs of the Institute), a president, three vice-presidents, and a secretary and treasurer or a secretary-treasurer. Patrons, president, and vice-presidents may be nominated by any District Council or at the annual meeting of the Dominion Council, and shall be elected at the annual meeting of the Dominion Council, and shall hold office until the first annual meeting of the Dominion Council subsequent to the date of their appointment. The secretary and treasurer or secretary-treasurer shall be elected by the executive, and shall hold office in accordance with conditions prescribed by the executive.

(*b.*) The president of the Dominion Council shall preside at all meetings. In the absence of the president a vice-president shall preside. If none of these officers are present the meeting shall elect a chairman.

(*c.*) Should the office of president or any other office become vacant from any cause, such vacancy shall be filled at the first ensuing executive meeting.

(*d.*) Councillors shall hold office from time of appointment until the appointment of their successors. Should a vacancy occur the executive of the unrepresented District Council or organization shall immediately appoint another representative. Should any District Council or other organization at its annual meeting fail to appoint a representative on the Dominion Council, or to fill within one month of such vacancy any vacancy that may occur, the executive may make the appointment at its first subsequent meeting.

(*e.*) A councillor may be suspended or expelled by a vote of two-thirds of those present at a meeting called for the purpose.

MEETINGS OF DOMINION COUNCIL.

8. (*a.*) The annual meeting of the Dominion Council shall be held not later than 30th June of each year.

(*b.*) Notices of any business for consideration at the annual meeting must be sent to the secretary of the council four weeks before the conference.

(*c.*) The secretary shall give not less than three months' notice of the date fixed for such meeting to each member of the Institute, and shall forward to the secretary of each District Council, at least fourteen days before the annual meeting, the annual report and balance-sheet and a notice of all business which it is proposed to lay before any meeting of the council.

(*d.*) The business of the annual meeting which shall take precedence of all other business shall be to receive report and balance-sheet; to elect officers; to elect an auditor; to consider all business of which one month's notice has been given to the secretary in writing.

(*e.*) A special meeting of the council shall be called by the secretary upon instructions from the Executive Committee, and upon receipt of a requisition setting forth the object of such meeting signed by the secretaries of not less than three District Councils.

(*f.*) At any meeting of the council ten members shall form a quorum.

Voting: The president or chairman of any meeting shall have a deliberative as well as a casting vote. Each councillor shall have one vote only. All resolutions shall be decided by a majority of votes cast by those present who are eligible to vote. Voting shall be recorded on the voices or by a show of hands. Notwithstanding the foregoing, however, a ballot may be demanded, provided that such demand is supported by one-third of the members present.

EXECUTIVE COMMITTEE.

9. (*a.*) The Executive Committee shall consist of seven members, and shall include the secretary and the treasurer to the council. All members of the Executive Committee except the secretary and treasurer shall be appointed by the Dominion Council at the annual meeting, and they shall continue in office until the close of the subsequent annual meeting of the council. The Dominion Council shall have power at any time to increase the Executive Committee to nine.

(*b.*) Five shall constitute a quorum for an executive meeting.

(*c.*) At all meetings of the executive the vote of the majority shall rule, and shall be by ballot if so desired by any member present, and the chairman shall have a deliberative as well as a casting vote.

(*d.*) It shall be the duty of the executive to carry out all the business of the Institute.

CONTROL OF COMMON SEAL.

10. The common seal of the Institute shall be kept in the control of the secretary, and shall be affixed to any document or writing only by resolution of the Executive Committee, by any member of such committee, the secretary, and the treasurer.

CONTROL AND INVESTMENT OF FUNDS.

11. All funds of the Institute shall be paid into the bank, to the credit of the Institute, and all accounts shall be passed by the Executive Committee and paid by cheque signed by the secretary or treasurer and any member of the Executive Committee.

12. With respect to the property and funds of the Institute the following provisions shall have effect:—

(*a.*) The Institute may (if its rules do not direct otherwise) invest the funds of the Institute or any part thereof to any amount in any of the following ways: (1.) In the purchase or lease in its own name of any land or buildings, and may hold, sell, exchange, mortgage, or lease the same upon whatever terms the executive considers to be in the interests of the Institute, and may build upon the same (with power to alter and pull down buildings and again rebuild); and no purchaser, assignee, mortgagee, or tenant shall be bound to inquire as to the authority for any sale, exchange, mortgage, or lease by the Institute; and the receipt of the Institute shall be a discharge for all moneys arising from or in connection with such sale, exchange, mortgage, or lease. (2.) In the Post Office Savings-bank, or in such other bank or banks as the executive may from time to time direct. (3.) In any debentures, bonds, Treasury bills, or inscribed stock issued by or on behalf of the Government under the authority of any Act or by any local authority or Harbour Board.

(*b.*) In advancing money by the Institute to members on the security of real or personal property.

(*c.*) The Institute may invest any part of its capital in the shares or on the security of any society registered under the Building Societies Act, 1908, or of any company registered under the Companies Act, 1908, or incorporated by Act or by charter, provided that no such investment shall be made in the shares of any society or company other than one with limited liability.

(*d.*) Any investment allowed by the Trustee Act, 1908, and its amendments.

(*e.*) All moneys so invested shall be invested under the Institute's incorporated name, and any receipts for moneys so invested shall be executed by affixing the seal as provided in clause 10.

POWER TO BORROW MONEY.

13. The Institute shall have power to borrow money for the purposes of the Institute upon any of its assets.

DISPOSITION OF PROPERTY OF INSTITUTE IN EVENT OF WINDING UP.

14. In the event of the Institute being wound up, any surplus after the payment of all liabilities and liquidating fees shall be given to some institute or society having similar objects as this Institute.

CAPITAL OF INSTITUTE.

15. The capital of the Institute shall be derived—

(*a.*) From a subscription of ten shillings (10s.) per annum to be paid by every person who is a member.

(*b.*) From annual subscriptions from societies, associations, companies, corporations, firms, and other bodies accepting the objects of the Institute and paying an annual subscription of one pound (£1) for every fifty members of such society, but not to exceed five pounds (£5) for any one society. The president, chairman, or head of such society, association, firm, or other body shall be a member of the District Council.

(*c.*) From special payments for special information required by or privileges granted to members, such sum to be sufficient to reimburse the council for expenses incurred in connection therewith.

(*d.*) From the Government or other bodies.

(*e.*) From legacies and endowments.

(*f.*) From any other source whatever.

FINANCIAL YEAR.

16. The Institute's financial year shall commence on the 1st April in each year, and all members' subscriptions shall be due and payable thereafter.

DISTRICT COUNCILS.

17. The following general rules shall be observed by and in relation to the District Councils of the Institute:—

(*a.*) All members in any given district shall belong to both the District Council and to the Institute; membership in one shall constitute membership in the other.

(*b.*) District Councils shall convene their own meetings, elect their own chairman, vice-chairmen, secretary, treasurer, and such other officers as they shall deem necessary.

(*c.*) The District Councils shall submit an annual report to the executive, covering all operations for the past year.

(*d.*) The District Councils may adopt such rules and by-laws as they may deem necessary.

(*e.*) District Councils may levy dues (subscriptions) on members within their district, provided that such do not exceed 40 per cent. of the annual dues levied by the Institute.

(*f.*) District Councils may, with the consent of the executive, raise funds within their respective districts for any special object or objects.

(*g.*) All actions and decisions of District Councils may at any time be reviewed, and if deemed by the executive to be an infringement of or antagonistic to the rules of the Institute may be altered, revised, or disallowed, as the case may be. Any District Council not satisfied with the decision of the executive may at the next annual meeting appeal to the Dominion Council for a ruling.

WEATHER RECORDS: APRIL, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE rainfall for the month of April was, generally speaking, above the average for the month in all the east-coast districts, but below the mean in Taranaki and west-coast districts of the South Island. These results were accounted for by ex-tropical disturbances, which brought heavy downpours in various districts. Thus on a single day in more than one place the quantity that fell was almost double the mean for the whole month in previous years. At Hamilton the maximum for one day was 5·12 in., at Tairua (Thames) 4·56 in., and at Tauranga 9·41 in., forming in great part the totals for the whole month. An amount of 4·19 in. fell in three days at Auckland. This heavy fall was accounted for by an ex-tropical storm, with easterly gales, which arrived on the 18th and passed in the north on the 22nd. While this occurred a "secondary" appears to have developed in the south, and one of the most serious floods on record in Dunedin took place. Rain commenced on Saturday night (21st) and continued for about thirty-six hours; 1·21 in. were credited to the 20th by the Dunedin observer, 6·81 in. to the 21st, and 0·43 in. to the 22nd, making a total of 8·45 in. for the three days.

The remarkable feature about these downpours in the northern and southern districts is that places between did not experience them. Thus the totals at places in the vicinity of Cook Strait are below the mean for the month. The west coast of the South Island recorded from 70 to 80 per cent. below the usual. The high lands of the South Island also do not show the average quantity of rain for April. Thus while Dunedin had almost four times the average, Queenstown, practically in the same latitude, was 45 per cent. below the mean, while farther south, Invercargill had a deficiency of 17 per cent.

RAINFALL FOR APRIL 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
North Island.	Inches.		Inches.	Inches.
Kaitaia	4·04	11	0·90	3·55
Russell	5·36	12	1·82	3·39
Auckland	5·00	10	2·34	3·33
Hamilton	7·01	10	5·12	3·64
Kawhia	5·42	10	3·06	4·75
New Plymouth	3·28	9	1·19	4·57
Inglewood	3·02	12	0·74	8·54
Whangamomona	3·08	11	1·38	6·68
Tairua, Thames	7·82	10	4·56	5·88
Tauranga	12·54	10	9·41	4·55
Maraehako Station (Opotiki) ..	7.00	9	3·24	5·22
Gisborne	6·72	12	2·58	4·26
Taupo	3·04	7	1·70	3·95
Maraekakaho Station, Hastings ..	3·15	11	1·13	3·54
Taihape	2·49	14	0·92	3·37
Masterton	2·67	13	0·46	3·18
Patea	2·77	8	1·27	3·95
Wanganui	1·47	3	0·95	3·59
Foxton	1·15	4	0·35	2·70
Wellington	3·08	12	0·88	3·92

RAINFALL FOR APRIL, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	1·24	7	0·40	6·50
Greymouth	1·90	6	0·64	8·83
Hokitika	2·18	9	0·74	9·20
Arthur's Pass	2·11	4	0·95	17·64
Okuru, Westland	3·30	6	1·32	13·67
Collingwood	2·42	8	0·59	8·07
Nelson	1·16	4	0·62	2·98
Spring Creek, Blenheim ..	1·39	5	0·48	1·91
Tophouse	1·01	4	0·52	4·03
Hanmer Springs	2·01	4	0·80	3·27
Waiau	2·00	8	0·70	1·75
Gore Bay	2·74	10	0·79	2·02
Christchurch	2·94	13	0·90	1·91
Timaru	2·22	12	0·84	1·49
Lambrook Station, Fairlie ..	1·36	5	0·66	2·00
Benmore Station, Omarama ..	1·78	7	0·76	2·52
Oamaru	4·91	7	4·26	1·76
Queenstown	1·95	4	0·78	2·92
Clyde	2·19	4	1·80	1·34
Dunedin	10·60	12	6·81	2·72
Gore	3·83	13	1·80	3·26
Invercargill	3·62	18	1·38	4·37

Correction: The total fall for March at Kawhia was 3·12 in., with fourteen wet days.

IMPORTATION OF FERTILIZERS, MARCH QUARTER.

FOLLOWING were the importations of fertilizers into New Zealand for the quarter ended 31st March, 1923:—*Sulphate of Ammonia:* Netherlands, 50 tons; United States, 205 tons. *Gypsum:* United Kingdom, 2 tons; Australia, 61 tons. *Nitrate of Soda:* United Kingdom, 25 tons; Chile, 65 tons. *Basic Slag and Thomas Phosphate:* United Kingdom, 1,381 tons; Belgium, 1,300 tons; United States, 1,000 tons. *Bonedust:* India, 175 tons; Australia, 555 tons. *Guano:* New Caledonia, 3,279 tons. *Rock Phosphate:* Nauru Island, 12,286 tons; Ocean Island, 7,319 tons. *Kainit:* United Kingdom, 75 tons; Belgium, 175 tons; France, 400 tons; Germany, 310 tons. *Muriate of Potash:* France, 10 tons. *Sulphate of Potash:* United Kingdom, 35 tons; Belgium, 25 tons; France, 40 tons; Germany, 60 tons. *Potash, other:* United Kingdom, 20 tons; France, 50 tons; Germany, 225 tons. *Sulphate of Iron:* United Kingdom, 5 tons. *Fertilizers, other:* United Kingdom, 1 ton.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 5th May: *Peas*—Market firmer; parcels of New Zealand Maple afloat have been resold for 85s. to 90s. per quarter, c.i.f.; 110s. ex store has been asked for shipments which have arrived, but no business reported. Tasmanian resale offered at 120s. ex store. Blue peas in slow demand and no business passing. Japanese green peas, May-June shipments, sold at 23s. 6d. per hundredweight. September-October shipments, 23s. *Beans*—Market quiet for imported. Chinese horse, spot, sold at 12s. per hundredweight; July-September shipments, 10s. 6d. English market quiet but steady at 9s. 6d. to 11s. New Zealand spot quoted at 49s. to 50s. per quarter.

BOARD OF AGRICULTURE.

THE personnel of the new Board of Agriculture, appointed by the Governor-General as from 30th April, 1923, is as follows: Sir J. G. Wilson, Messrs. E. Hall, G. L. Marshall, W. Perry (Government nominees), E. D. McLennan (Auckland District), E. Averill (Hawke's Bay), W. B. Grant (Taranaki), J. H. Perrett (Wellington), J. A. Haycock (Nelson and Marlborough), D. W. Westenra (Canterbury), J. Begg (Otago), and D. Marshall (Southland). Sir J. G. Wilson has been named as President in accordance with the provisions of the Board of Agriculture Act.

IMPORTATION OF LIVE-STOCK FROM BRITAIN.

EARLY last year, owing to the prevalence of foot-and mouth disease in the United Kingdom, it became necessary to prohibit the importation into New Zealand of cattle, sheep, and swine, also fodder therefor, from the former country. The Department of Agriculture has been keeping close touch with the position, and as recent advices disclose that the disease is apparently not of an epidemic nature it has now been decided to again permit importations subject to certain conditions, which are similar to those in operation prior to the last series of outbreaks. Briefly, these conditions are as follows: No shipment allowed from part of the country for one month from the date of the outbreak. For the succeeding two months shipments only allowed from outside a radius of fifteen miles: Provided that if animals are taken from an area free from disease and quarantined in approved premises under veterinary supervision for fourteen days prior to shipment, then such shipment would be allowed.

An Order in Council will be issued shortly formally removing the embargo on the live-stock stated, but in the meantime all fodder will have to be dumped before vessels carrying stock from Great Britain enter port in New Zealand.

EXPORT OF FRUIT AND PLANTS TO MONTE VIDEO.

WITH reference to the certificate required to accompany fruit, plants, &c., shipped from New Zealand to Monte Video, the Department has received advice to the effect that the Uruguayan regulation governing this matter has now been amended, and reads as follows: "Every consignment of plants, their parts, and fresh fruit, must be accompanied by a sanitary certificate of the exporting country, issued by the competent authorities, declaring that the same have been inspected, and are free of diseases harmful to plants, fruit, &c."

San Jose scale being covered in the above, the special certificate previously required in regard to this disease is not now necessary. As the Department's ordinary export certificate of freedom from disease practically complies with the Uruguayan requirements, this certificate will be issued in future by the Department's officers in connection with any consignments of fruit, plants, &c., exported to that country. (For previous reference to this matter see *Journal*, August, 1922, page 127.)

FORTHCOMING WINTER SHOWS.

Waikato Winter Show Association: Hamilton, 29th May to 4th June.
Otago A. and P. Society: Dunedin, 5th to 8th June.
Taranaki Metropolitan Agricultural Society: New Plymouth, 6th to 9th June.
Manawatu A. and P. Association: Palmerston North, 19th to 22nd June.
South Taranaki Winter Show Company: Hawera, 3rd to 7th July.
Auckland A. and P. Association: Auckland, 17th to 21st July.